AERO MODELLER

ANNUAL 1954-5

AEROMODELLER ANNUAL 1954-55

WITH its seventh appearance AEROMODELLER ANNUAL begins to take on the character of an institution. Many experienced aeromodellers are lucky enough to possess the complete set of volumes covering the progress of the hobby since 1948, but the newcomer can quite happily begin his collection with this volume, for each is complete in itself providing a summary of the main features of the aeromodelling year. We are constantly endeavouring to make each year's volume better than the one before, and AEROMODELLER ANNUAL 1954-55 for the first time provides its readers with a real full colour painting for the dust-cover, preserving it for all time by repeating it within as a frontispiece. That famous *Aeromodeller* artist, C. Rupert Moore, A.R.C.A. was specially commissioned to provide this flashback to the Battle of Britain, and has moreover contributed a most valuable article on post-war British camouflage, summarising available information never before published in this form.

Parnell Schoenky of Kirkwood, Missouri, provides yet another world-famous expert amongst our contributors, and his advice on helicopter models can hardly be bettered. Just van Hattum of Holland offers a splendid summary of A/2 Sailplane development in Europe: George Honnest-Redlich, E.D.'s electronic expert, provides factual information on radio control actuators: Ron Moulton gives the results of a most exhaustive series of timer tests—"gen" that must prove invaluable to every contest flyer.

On the plans side we have again combed the aeromodelling literature of the world and contacted our overseas correspondents, to provide the most interesting selection of record, novel, curious and interesting designs that have been flown in France, Japan, Poland, Czechoslovakia, U.S.A., Italy, Germany, and Gt. Britain, including several specially produced for the *Annual*.

AEROMODELLER ANNUAL - 1954-5

A review of the year's aeromodelling throughout the world in theory and practice; together with useful data, contest results and authoritative articles, produced by staff and contributors of the *AEROMODELLER*

Compiled by
D. J. LAIDLAW-DICKSON
and Edited by
C. S. RUSHBROOKE, F.S.M.A.E.

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AEROMODELLER ANNUAL 1949-1953

MODEL DIESELS

CONTROL LINE MODEL AIRCRAFT

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** Plans available from "Aeromodeller Plans Service."*

AEROMODELLER ANNUAL 1954-55

Acknowledges with thanks the undernoted sources, representing the cream of the world's aeromodelling literature:

AEROFAN	JAPAN
AERO MODELAR	JUGOSLAVIA
ALI	ITALY
FLYING MODELS	U.S.A.
LETECKY MODELAR	CZECHOSLOVAKIA
MECHANIKUS	GERMANY
MODEL AIRPLANE NEWS	U.S.A.
MODELE MAGAZINE	FRANCE
MODELE REDUIT D'AVION	FRANCE
MODELL-TECHNIK UND SPORT	GERMANY
MODELLISMO	ITALY
SKRZYDLATA POLSKA	POLAND

Contributors in this year's Annual include:

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JUST VAN HATTUM
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RON MOULTON
PARNELL SCHOENKY
VIC SMEED
RON WARRING
FRANK ZAIC

INTRODUCTION

A Year of Technical Progress

THROUGHOUT the world aeromodelling continues to advance at such a pace that technical achievement tends to outstrip the ability of builders and fliers to make full use of all that is within their grasp. For that reason, coupled perhaps with an exceptionally wet summer which may have had adverse effects in this country at least, 1954 must be regarded as a year of sitting back and taking stock. Development that has taken place has leaned towards the unorthodox, with increasing interest in such layouts as the helicopter—sometimes in rather weird and wonderful forms!—the ornithopter, and a revival of activity amongst microfilm specialists, thanks to opportunities of indoor flying unequalled anywhere in the world.

With an American venue for both the International Power event and the Wakefield, European participation was disappointing. Lack of finance prevented anything more than a proxy representation from British teams, earlier hopes of sponsorship falling through at the last moment. Even proxy entries, however, failed to materialise from the French and Belgian teams who have supported these events so keenly in the past. We would deplore this lack of support, particularly as contingents from the United States, Canada, and even distant Argentine have competed in Europe. The brightest spot of this ill-supported meeting is in the victory of Alan King of Australia who takes the Wakefield Trophy "down under" for the first time in its long history. We can safely say that nothing short of a British victory for our own team could please us as much as this Aussie win, coming after years of proxy entry from a "personal appearance" of the winner, participating thanks to an all-nation whip round by his compatriots.

The Swedish Cup World Glider event took place in Denmark with active British participation, and resulted in a German victory. Our entries were somewhat far down the list, but it is echoing a general opinion to voice our disquiet at the present trend of A/2 development, where the abolition of a fuselage cross-section rule is producing monstrous stick models that compare with design in the middle twenties, save only for progress in airfoil research.

It is encouraging therefore to look at the progress taking place in radio control, which is moving steadily forward to a pre-eminent place on the truly scientific side of the hobby. British enthusiasts have realised the need to re-learn the flying side of the hobby, in order that they can make full use of the vast possibilities of reed control. The fine control shown by the German winners at Brussels this year convinced all who saw them of the vital necessity of many hours of actual flying practice. We have equipment that is in demand all over the world, but not a single flyer who has been able to devote enough time to learn how to fly with it at its theoretical peak performance!

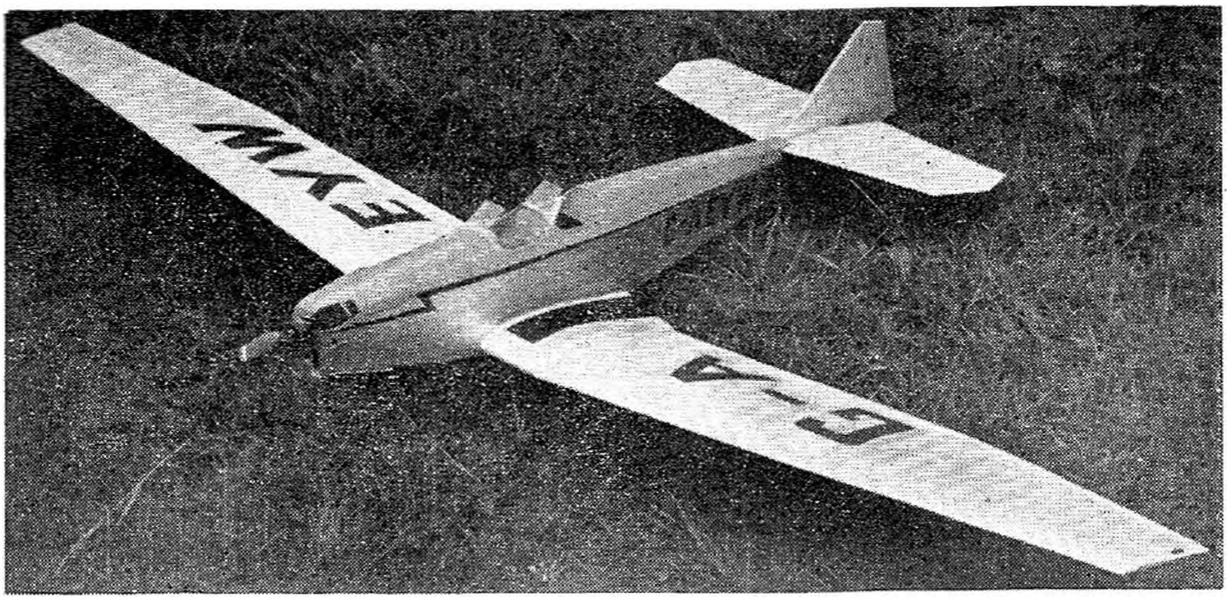
Control line flying is entering a new phase. Team racing has established itself not only as a spectacle, but also as the medium by which so many of the more exuberant spirits can best express themselves. Entries amount to as many as a hundred teams at the main events, and while one or two individuals and clubs are to the forefront, no outstanding "expert group" has arisen to dampen the enthusiasm of the average enthusiast, a fate which befell stunt control line flying within a year or two of achieving popularity. A sturdy offshoot which owes something to both team racing and stunt flying is to be found in combat flying. This branch of control line appeals particularly to the individualist, who might not be at his best as a member of a team, or, again might not be able to find two suitable team mates to complete a team.

Manufacturers have continued during 1953 to provide their customers with the goods they really want. The standard of model kit production continues to improve and a number of semi-pre-fabricated models are coming on the market, where wood cutting reflects improved methods of machining that should encourage the newcomer to more ambitious beginnings. Engines have now reached what must be the peak of perfection on the British market, so that it can honestly be said there are no bad engines, the choice depending solely on fitness for purpose, in all groups from beginners' engines to specialist types for radio control, team racing, speed or free flight in sports or competition classes. A notable newcomer was the world's smallest production engine, the Allbon Bambi at .15 c.c., which has made available for the first time a really tractable example in this sub-miniature size. Jetex have devoted the past twelve months to consolidating their position at home and abroad with improved marketing methods, and the development of their "tailored" kits of scale jet aircraft.

A comparison of contest entries during the years that AEROMODELLER ANNUAL has been appearing reveals a somewhat alarming fall in numbers. Whereas in 1948 and 1949 figures of around four hundred were not too many to expect for a popular decentralised event, today it is almost unknown for half as many to record their times, whilst figures of under one hundred are becoming normal. At a time when aeromodelling as a hobby is booming this would seem to be a contradictory trend. We know, statistically, that there are more keen aeromodellers in this country today than, say, five years ago, but the drift is away from competition flying towards sports flying, scale models, radio control and indeed all those branches of the sport that demand smaller and less elaborate flying fields. That we feel is the crux of the matter. At one time every club, whatever its size, boasted a flying field of its own, but today with a reduction in the number of open spaces available to aeromodellers such luxury is far from being the case. Many clubs can only meet at a central venue arranged by their area, so that those jolly days flying in the local park seem to be gone for ever, and with them a degree of the local spirit of camaraderie that made club life so enjoyable. We would urge every club therefore that still enjoys its own flying ground to guard it zealously, look upon it as a treasure that cannot be replaced.

The S.M.A.E. has been quick to detect this new tempo amongst aeromodellers, and is catering for the non-contest flying enthusiast as never before. By the end of the year the number of flyers who have taken up associate membership combined with third party insurance may well be equalling if not exceeding the total strength of membership through clubs. We welcome this extension of activity by the governing body, who may now really claim in all truth to be representing the whole body of aeromodelling rather than a cross-section only, which has been the contention of their detractors for so many years.

Finally, we would close on the usual note of our annual prologue, with the hope that you like the fare provided. We would thank our readers for their many practical suggestions, our contributors for their articles, and the model press of the world for much of the material that goes to make up AEROMODELLER ANNUAL 1954-55.

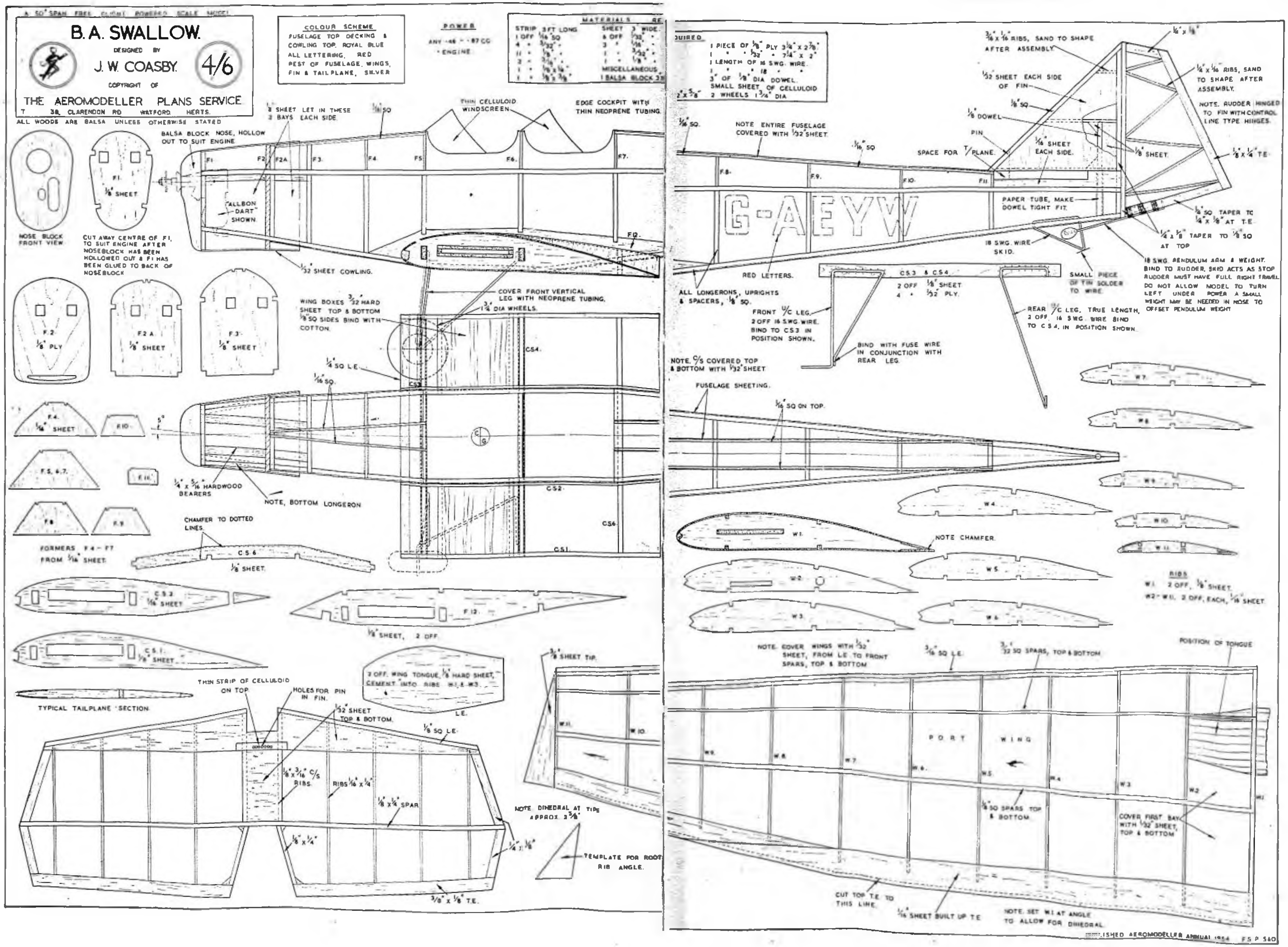


B.A. SWALLOW FOR .5 c.c. MOTOR

By J. W. COASBY

THE ancestry of the Swallow II can be traced back to the German Klemm L.25, several of which were imported into this country during 1930-31. In 1933 the type was manufactured over here by the British Klemm Aeroplane Co., Ltd., of Feltham, the fore runners of the British Aircraft Manufacturing Co., Ltd. The final version produced in 1935 proved extremely popular in civil aviation and, by September, 1939, over 150 machines had been registered in this country alone. A number were privately owned, but the majority belonged to various schools and clubs.

Building Instructions. Lay plan side view over 1/32-in. sheet and trace through the complete flat side view including slots for C/S L.E. and spars. Repeat for other side of the fuselage. Cut out F.12 and glue into position on side sheets then install all uprights. Prop up sides over plan view and install cross pieces, remove from plan, cut out and cement in all formers with the exception of F.1. Cut to length, drill for engine bolts and install engine bearers. Cut out C.S.2 and C.S.6 and cement into position. Slots in F.12 for C.S.6 will have to be enlarged a little; this can be remedied after C.S.6 is in position. Install 1/16-in. sq. stringers on top decking, then cover with 1/32-in. sheet. Make up C.S.3 and C.S.4. Pierce for U/C thread binding and cement into fuselage. Form U/C and bind into position. Install C/S L.E. Cut out C.S.1 and cement in position. Make up wing boxes and install into position. Cover bottom of fuselage with 1/32-in. sheet. Form tailskid wire, bind to piece of very hard balsa or hardwood and cement into fuselage. Solder small piece of tin 3/16-in. by 3/8-in. to bottom of skid. Cut out and cement on top of top longerons at rear the 1/16-in. sheet tailplane rests. The paper tube to take fin dowel is not glued in until fin is made. Cut out F.1 and noseblock. Check that F.1 fits onto longerons and bearers. Remove and cement to back of noseblock. Temporarily bolt engine into position and hollow out noseblock to fit. Side cowling pieces are next cut and cemented into position. Top and bottom cowlings are


B.A. SWALLOW.
DESIGNED BY
J. W. COASBY.
4/6
COPYRIGHT OF
THE AEROMODELLER PLANS SERVICE
ALL WOODS ARE BALSA UNLESS OTHERWISE STATED
COLOUR SCHEME
FUSELAGE TOP DECKING & COWLING TOP, ROYAL BLUE
ALL LETTERING, RED
REST OF FUSELAGE, WINGS, FIN & TAILPLANE, SILVER
POWER
ENGINE
MATERIALS
MISCELLANEOUS
THIN CELLULOID WINDSCREEN
EDGE COCKPIT WITH THIN NEOPRENE TUBING.
BALSA BLOCK NOSE, HOLLOW OUT TO SUIT ENGINE
NOSE BLOCK FRONT VIEW
CUT AWAY CENTRE OF F1, TO SUIT ENGINE AFTER NOSEBLOCK HAS BEEN HOLLOWED OUT & F1 HAS BEEN GLUED TO BACK OF NOSEBLOCK
"ALLBON DART" SHOWN
1/32" SHEET COWLING.
COVER FRONT VERTICAL LEG WITH NEOPRENE TUBING.
1 3/4" DIA WHEELS.
NOTE, BOTTOM LONGERON
CHAMFER TO DOTTED LINES.
FORMERS F4 – F7 FROM 1/16" SHEET.
TYPICAL TAILPLANE SECTION
THIN STRIP OF CELLULOID ON TOP.
HOLES FOR PIN IN FIN.
1/32" SHEET TOP & BOTTOM.
1/8" SQ L.E.
1/8" x 1/4" SPAR
3/8" x 1/8" T.E.
NOTE DIHEDRAL AT TIPS APPROX 2 3/8"
TEMPLATE FOR ROOT RIB ANGLE.
G-AEYW
NOTE ENTIRE FUSELAGE COVERED WITH 1/32" SHEET.
SPACE FOR T/PLANE.
PAPER TUBE, MAKE DOWEL TIGHT FIT.
18 SWG. WIRE SKID.
RED LETTERS.
ALL LONGERONS, UPRIGHTS & SPACERS, 1/8" SQ.
NOTE: RUDDER HINGED TO FIN WITH CONTROL LINE TYPE HINGES.
NOTE C/S COVERED TOP & BOTTOM WITH 1/32" SHEET
FUSELAGE SHEETING.
NOTE CHAMFER.
RIBS
W1 2 OFF, 1/8" SHEET.
W2 – W11, 2 OFF, EACH, 1/16" SHEET
NOTE: COVER WINGS WITH 1/32" SHEET, FROM L.E. TO FRONT SPARS, TOP & BOTTOM
POSITION OF TONGUE
PORT WING
CUT TOP T.E. TO THIS LINE.
NOTE: SET W1 AT ANGLE TO ALLOW FOR DIHEDRAL.

then each made in one piece. Cover C/S top and bottom with 1/32-in. sheet grain spanwise.

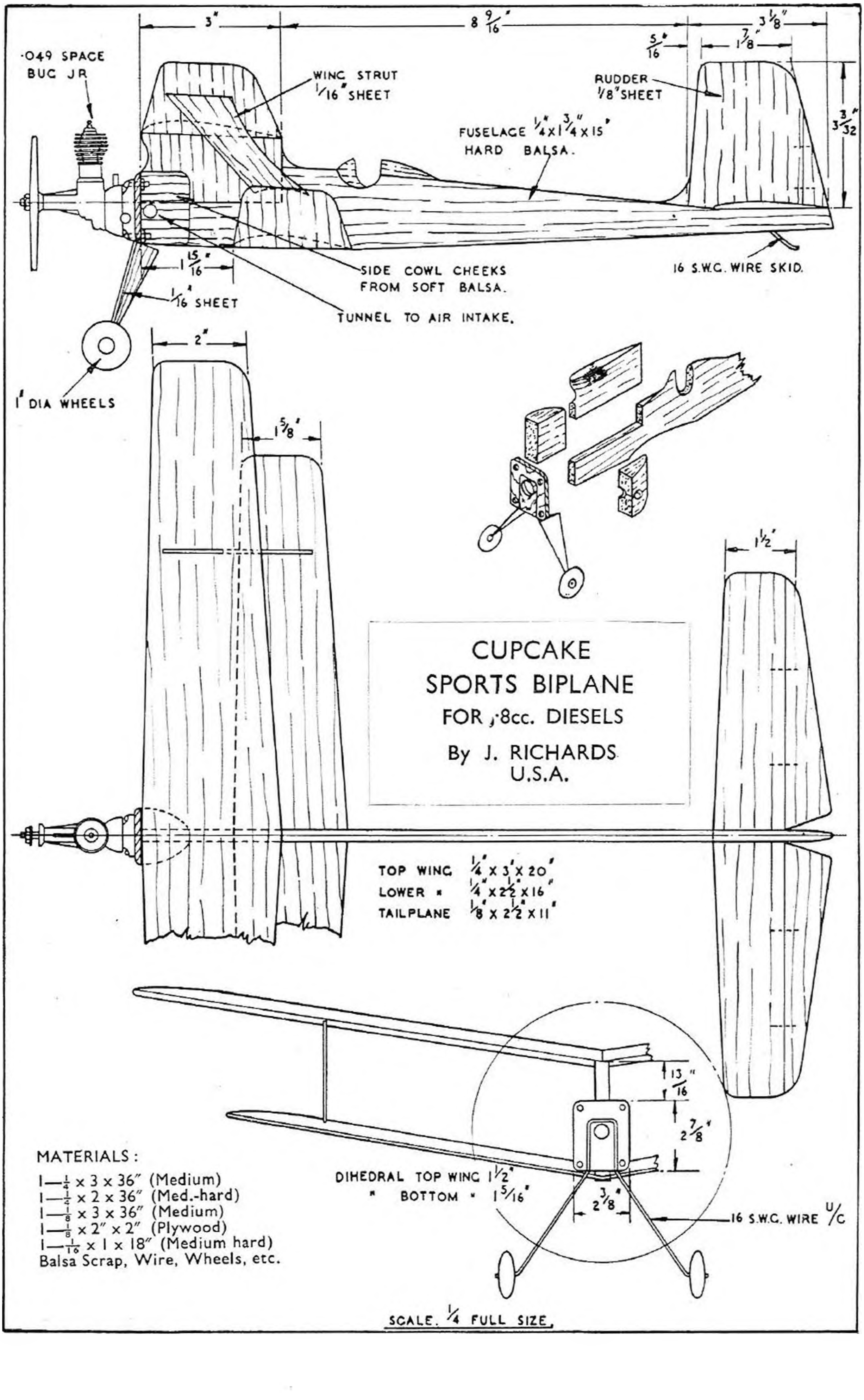
Wings. Cut out bottom T.E. and lay into position together with bottom spars, install ribs and tip, then top spars and L.E. Taper L.E. a little at tip before cementing into position. Cut out top T.E. and chamfer inside edge, and cement to ribs and bottom T.E. Cover top between L.E. and front spars with 1/32-in. sheet. When dry remove from plan and cover bottom between L.E. and front spar with 1/32-in. sheet. Repeat procedure for starboard wing. Cut out and install wing tongues making certain that root ribs line up with C/S ribs. Cover first bay top and bottom with 1/32-in. sheet.

Tailplane. Lay spar L.E. and T.E. into position. Raise L.E. and T.E. with 1/16-in. packing. Cut out ribs and tips and cement into position. Cut top and bottom L.E. sheet pieces. Cement on top piece and thin celluloid strip. When dry remove from plan and cement on bottom piece and cover centre bay top and bottom with 1/32-in. sheet.

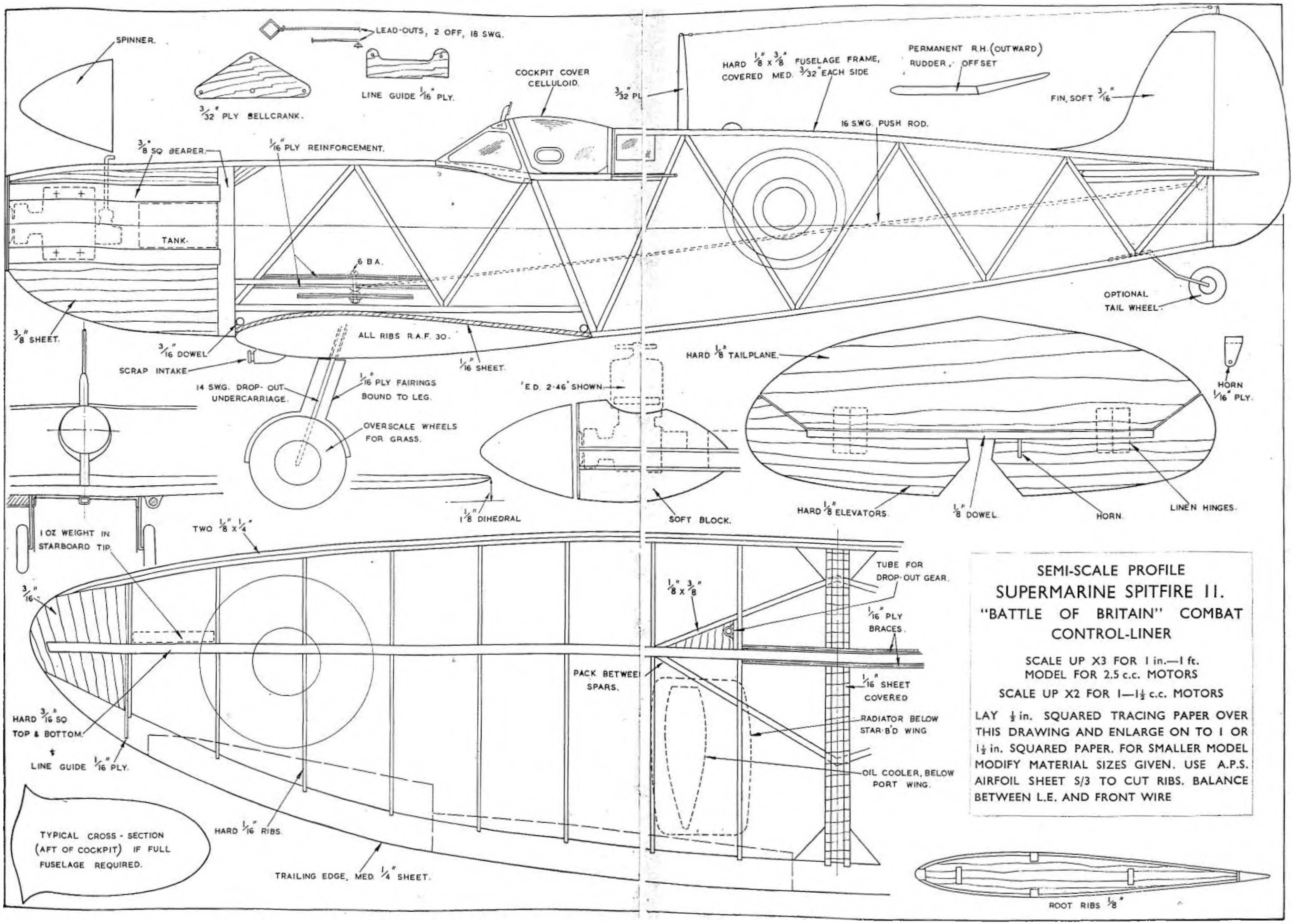
Fin and Rudder. Construct as for tailplane except that ribs are sanded to a streamline shape after assembly. Connect rudder to fin with control-line type hinges. Roll paper tube around fin dowel and cement tube into fuselage with fin in position. Make up and bind pendulum to rudder.

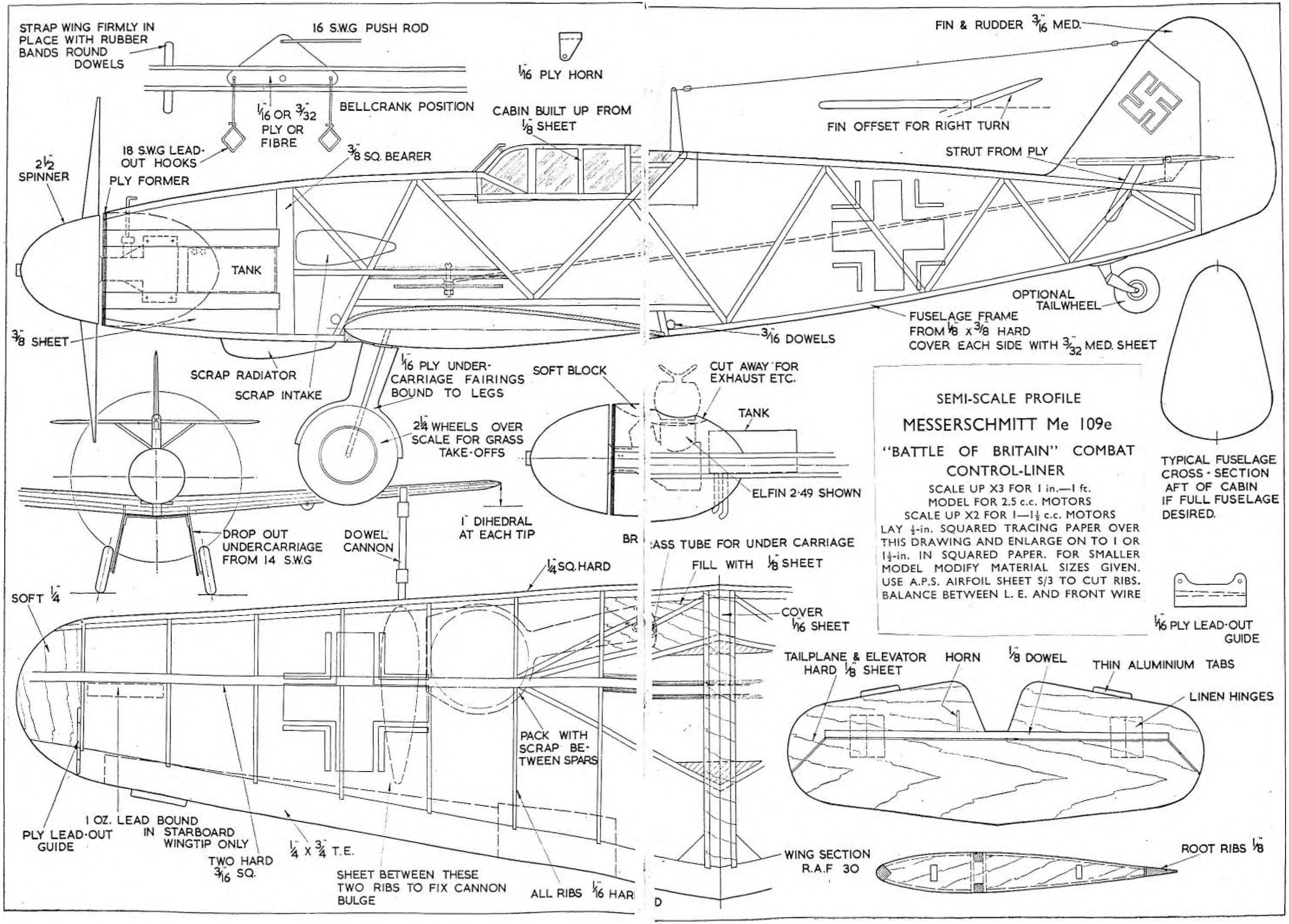
Trimming. All test flying should be carried out over long grass on a perfectly calm day. Assemble the model and check that C.G. is in position shown on plan. Test glide model until it glides flatly with a slight right turn. Obtain the right turn by adjustments to the fin in holes in tailplane. The original model did not need any alteration to tailplane incidence.

Adjust motor to half power and hand launch slightly across wind (if any) to the right. Model should power glide in trying to turn left. Start motor again and increase power. This time model should climb very gently and the pendulum rudder takes over when model tries to turn left. This should result in a straight climb and a very gentle right glide turn. Adjust fin another notch to the left and allow motor to run at 3/4 power. When launched, model should climb gently to the right and increase its right turn slightly in the glide. The model does not need any extra power for flying and if full power is used this will require extra left fin adjustment with subsequent loss of glide owing to increased right turn.

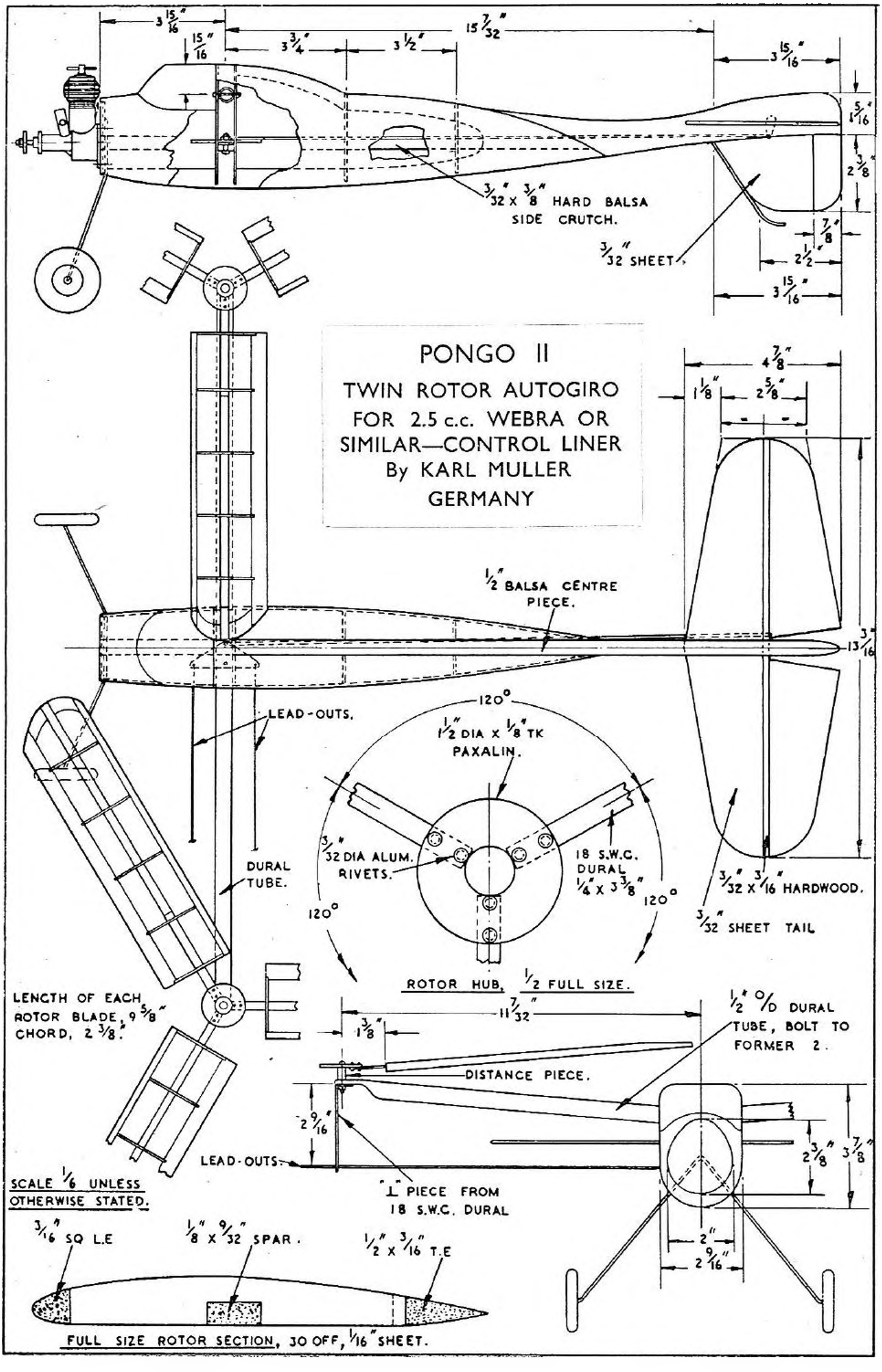


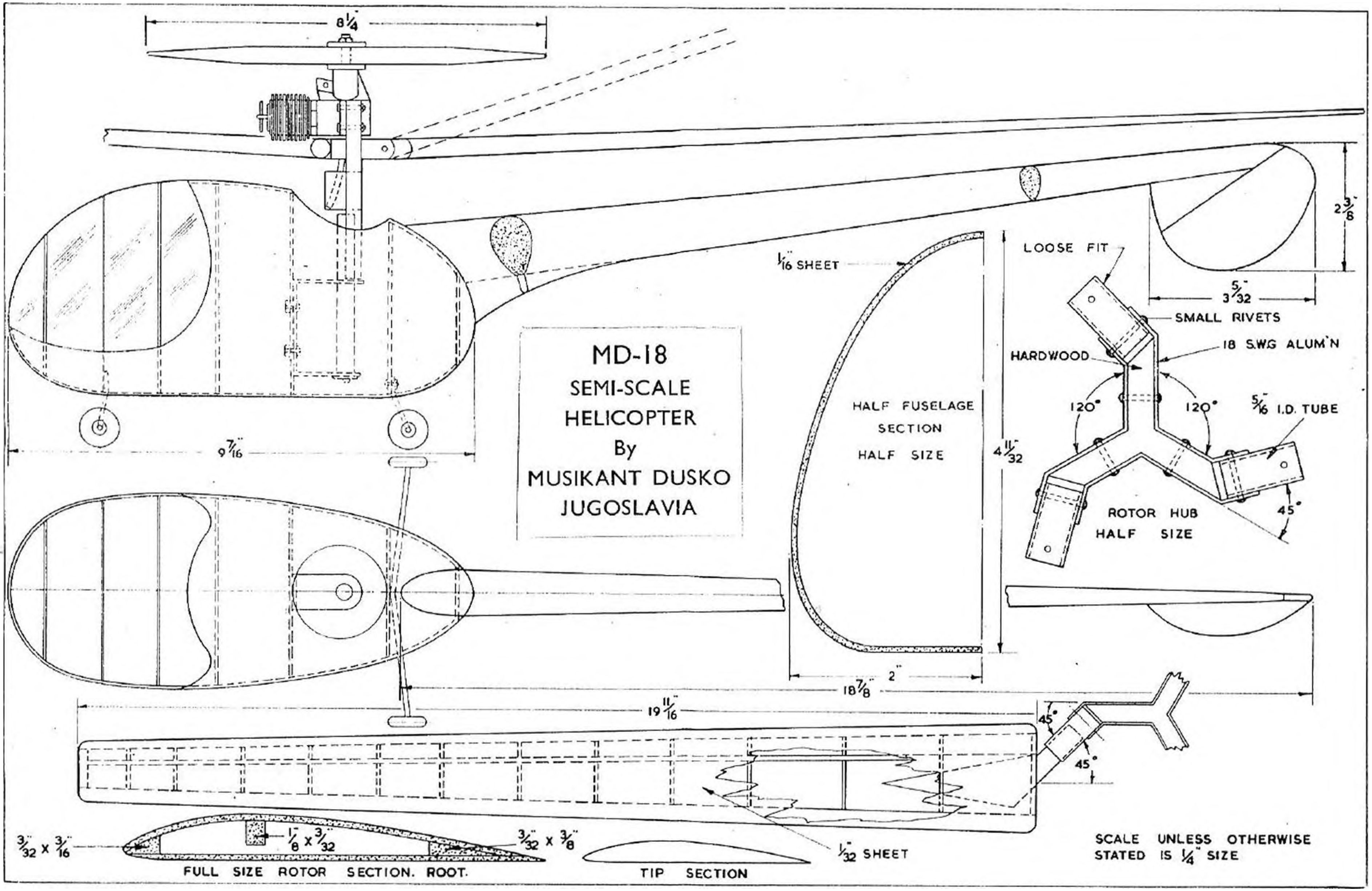
·049 SPACE BUG JR
WING STRUT 1/16" SHEET
RUDDER 1/8" SHEET
FUSELAGE 1/4" x 1 3/4" x 15" HARD BALSA.
SIDE COWL CHEEKS FROM SOFT BALSA.
TUNNEL TO AIR INTAKE.
16 S.W.G. WIRE SKID.
1/16" SHEET
1" DIA WHEELS
CUPCAKE
SPORTS BIPLANE
FOR ·8cc. DIESELS
By J. RICHARDS
U.S.A.
TOP WING 1/4" x 3" x 20"
LOWER " 1/4" x 2 1/2" x 16"
TAILPLANE 1/8" x 2 1/2" x 11"
MATERIALS:
1—1/4 x 3 x 36" (Medium)
1—1/4 x 2 x 36" (Med.-hard)
1—1/8 x 3 x 36" (Medium)
1—1/8 x 2" x 2" (Plywood)
1—1/16 x 1 x 18" (Medium hard)
Balsa Scrap, Wire, Wheels, etc.
DIHEDRAL TOP WING 1 1/2"
" BOTTOM " 1 5/16"
16 S.W.G. WIRE U/C
SCALE. 1/4 FULL SIZE.


SEMI-SCALE PROFILE
SUPERMARINE SPITFIRE II.
"BATTLE OF BRITAIN" COMBAT CONTROL-LINER
SCALE UP X3 FOR 1 in.—1 ft. MODEL FOR 2.5 c.c. MOTORS
SCALE UP X2 FOR 1—1½ c.c. MOTORS
LAY ½ in. SQUARED TRACING PAPER OVER THIS DRAWING AND ENLARGE ON TO 1 OR 1½ in. SQUARED PAPER. FOR SMALLER MODEL MODIFY MATERIAL SIZES GIVEN. USE A.P.S. AIRFOIL SHEET S/3 TO CUT RIBS. BALANCE BETWEEN L.E. AND FRONT WIRE
SPINNER.
LEAD-OUTS, 2 OFF, 18 SWG.
3/32" PLY BELLCRANK.
LINE GUIDE 1/16" PLY.
COCKPIT COVER CELLULOID.
3/32" PL
HARD 1/8" x 3/8" FUSELAGE FRAME, COVERED MED. 3/32" EACH SIDE
PERMANENT R.H. (OUTWARD) RUDDER OFFSET
FIN, SOFT 3/16"
3/8" SQ BEARER.
1/16" PLY REINFORCEMENT.
16 SWG. PUSH ROD.
TANK.
6 B.A.
OPTIONAL TAIL WHEEL.
3/8" SHEET.
3/16" DOWEL.
ALL RIBS R.A.F. 30.
SCRAP INTAKE
1/16" SHEET.
HARD 1/8" TAILPLANE.
HORN 1/16" PLY.
14 SWG. DROP-OUT UNDERCARRIAGE.
1/16" PLY FAIRINGS BOUND TO LEG.
E.D. 2·46' SHOWN.
OVERSCALE WHEELS FOR GRASS.
1/8" DIHEDRAL
SOFT BLOCK.
HARD 1/8" ELEVATORS.
1/8" DOWEL.
HORN.
LINEN HINGES.
1 OZ WEIGHT IN STARBOARD TIP.
TWO 1/8" x 1/4"
3/16"
TUBE FOR DROP-OUT GEAR.
1/8" x 3/8"
1/16" PLY BRACES.
PACK BETWEEN SPARS.
1/16" SHEET COVERED
RADIATOR BELOW STAR-B'D WING
OIL COOLER, BELOW PORT WING.
HARD 3/16" SQ TOP & BOTTOM.
&
LINE GUIDE 1/16" PLY.
TYPICAL CROSS-SECTION (AFT OF COCKPIT) IF FULL FUSELAGE REQUIRED.
HARD 1/16" RIBS.
TRAILING EDGE, MED. 1/4" SHEET.
ROOT RIBS 1/8"

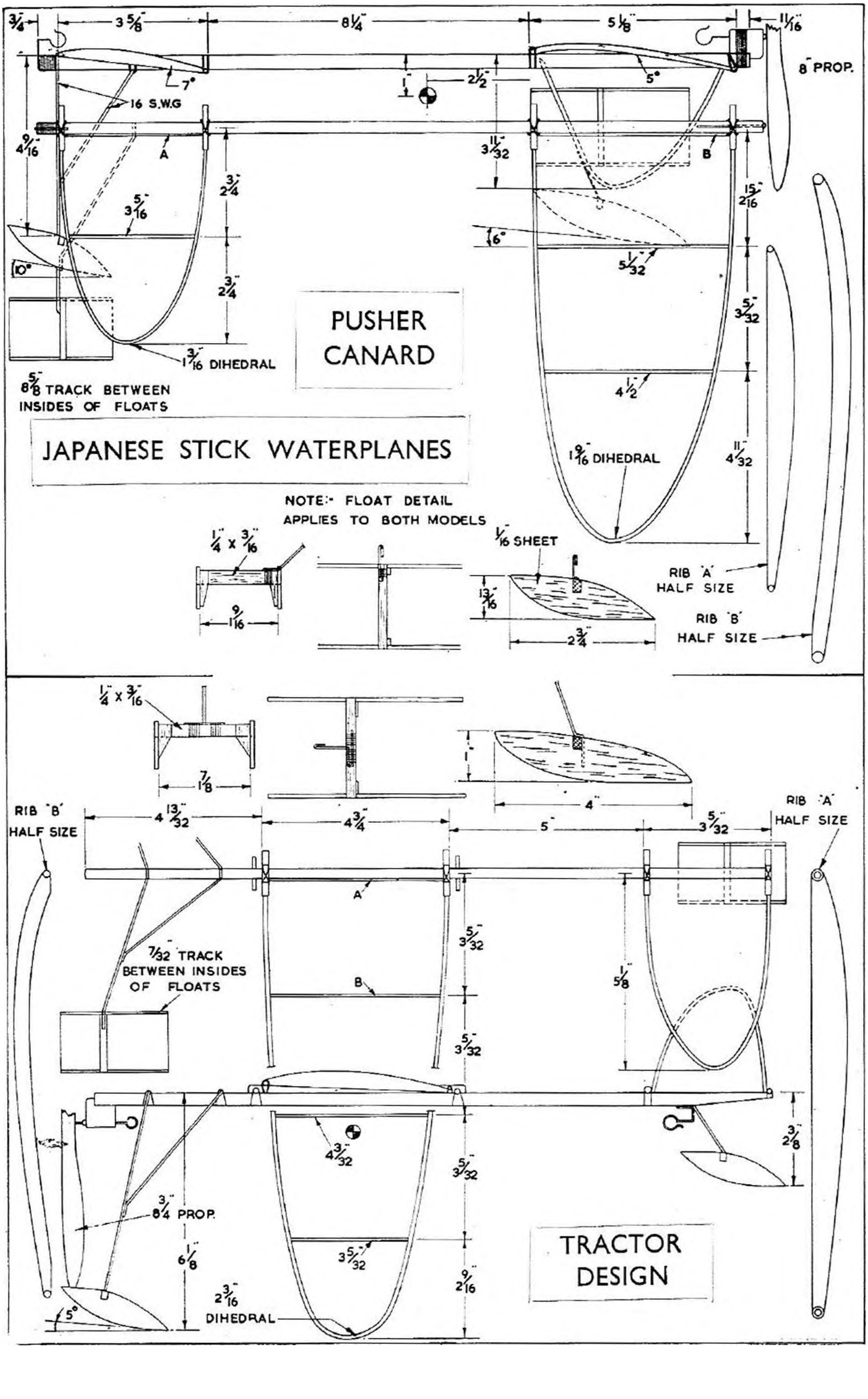


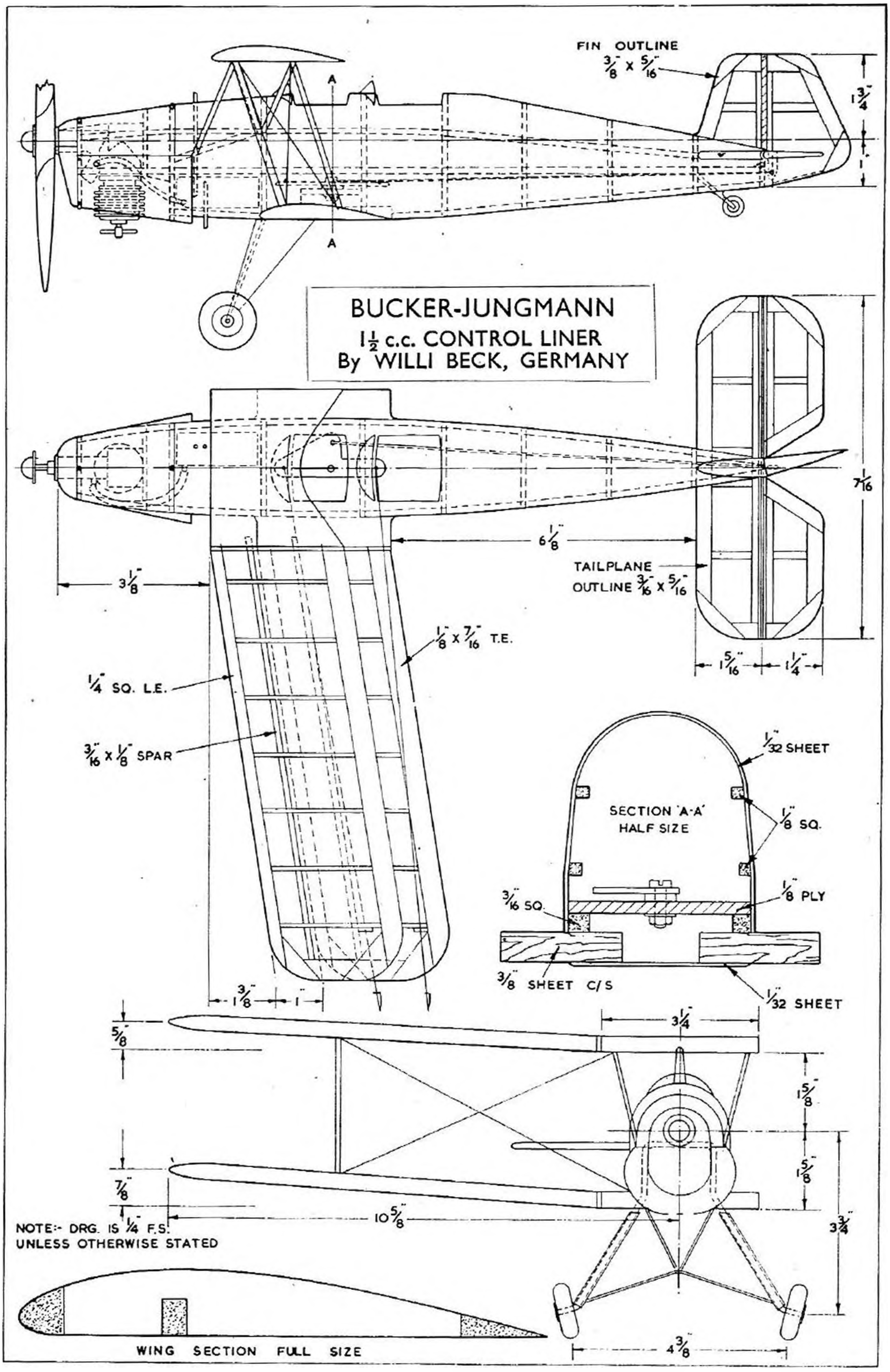
STRAP WING FIRMLY IN PLACE WITH RUBBER BANDS ROUND DOWELS
16 S.W.G PUSH ROD
1/16 PLY HORN
1/16 OR 3/32 PLY OR FIBRE
BELLCRANK POSITION
CABIN BUILT UP FROM 1/8 SHEET
18 S.W.G LEAD-OUT HOOKS
3/8 SQ. BEARER
2½ SPINNER
PLY FORMER
TANK
3/8 SHEET
SCRAP RADIATOR
SCRAP INTAKE
1/16 PLY UNDER-CARRIAGE FAIRINGS BOUND TO LEGS
SOFT BLOCK
2¼ WHEELS OVER SCALE FOR GRASS TAKE-OFFS
1" DIHEDRAL AT EACH TIP
DROP OUT UNDERCARRIAGE FROM 14 S.W.G
DOWEL CANNON
BRASS TUBE FOR UNDER CARRIAGE
1/4 SQ. HARD
SOFT 1/4
PACK WITH SCRAP BETWEEN SPARS
1 OZ. LEAD BOUND IN STARBOARD WINGTIP ONLY
PLY LEAD-OUT GUIDE
TWO HARD 3/16 SQ.
1/4 x 3/4 T.E.
SHEET BETWEEN THESE TWO RIBS TO FIX CANNON BULGE
ALL RIBS 1/16 HARD
FIN & RUDDER 3/16 MED.
FIN OFFSET FOR RIGHT TURN
STRUT FROM PLY
OPTIONAL TAILWHEEL
FUSELAGE FRAME FROM 1/8 x 3/8 HARD
COVER EACH SIDE WITH 3/32 MED. SHEET
3/16 DOWELS
CUT AWAY FOR EXHAUST ETC.
TANK
ELFIN 2·49 SHOWN
SEMI-SCALE PROFILE
MESSERSCHMITT Me 109e
"BATTLE OF BRITAIN" COMBAT CONTROL-LINER
SCALE UP X3 FOR 1 in.—1 ft.
MODEL FOR 2.5 c.c. MOTORS
SCALE UP X2 FOR 1—1½ c.c. MOTORS
LAY ½-in. SQUARED TRACING PAPER OVER THIS DRAWING AND ENLARGE ON TO 1 OR 1½-in. IN SQUARED PAPER. FOR SMALLER MODEL MODIFY MATERIAL SIZES GIVEN. USE A.P.S. AIRFOIL SHEET S/3 TO CUT RIBS. BALANCE BETWEEN L. E. AND FRONT WIRE
TYPICAL FUSELAGE CROSS-SECTION AFT OF CABIN IF FULL FUSELAGE DESIRED.
1/16 PLY LEAD-OUT GUIDE
FILL WITH 1/8 SHEET
COVER 1/16 SHEET
TAILPLANE & ELEVATOR HARD 1/8 SHEET
HORN
1/8 DOWEL
THIN ALUMINIUM TABS
LINEN HINGES
WING SECTION R.A.F 30
ROOT RIBS 1/8

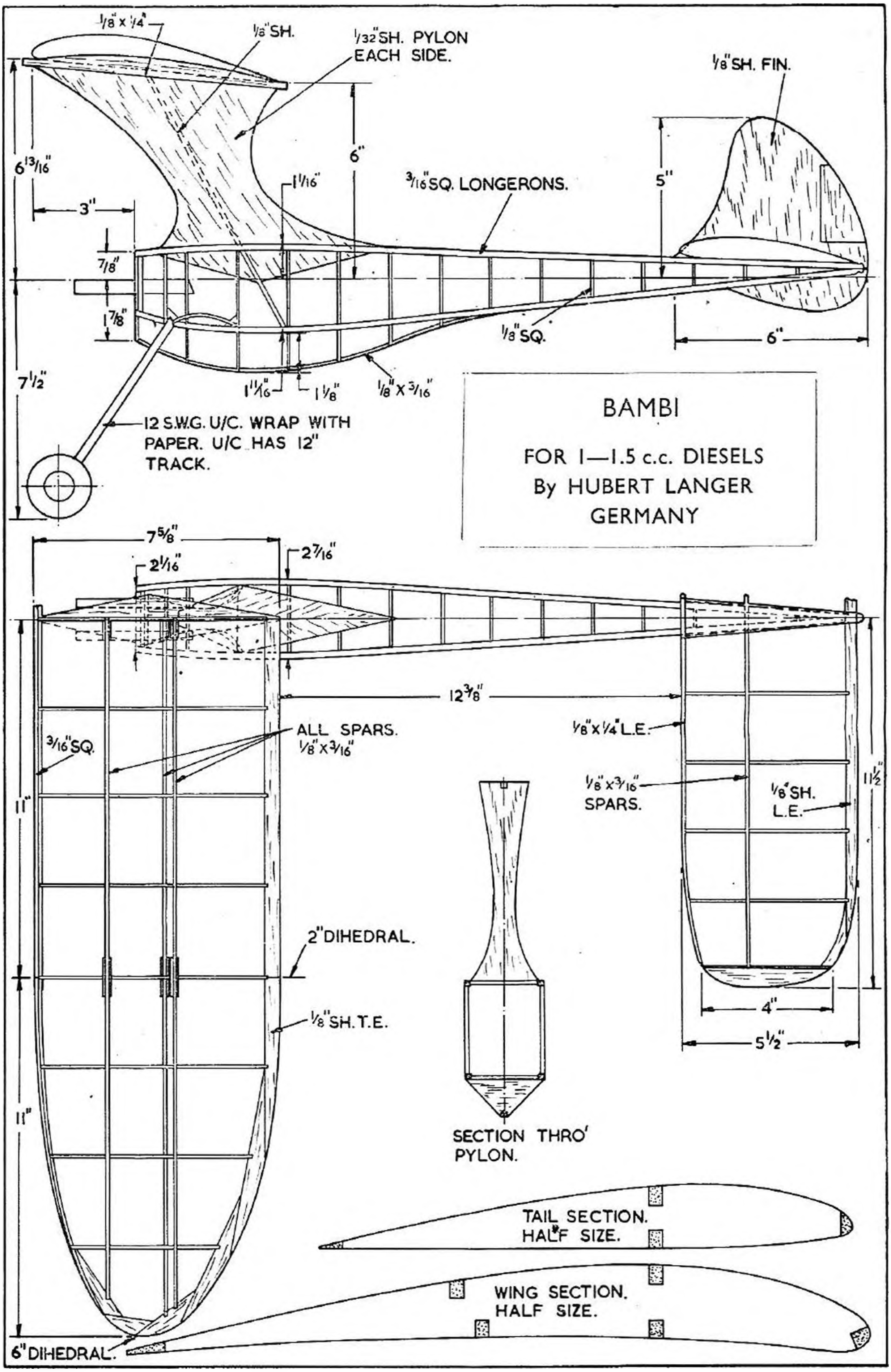

PONGO II
TWIN ROTOR AUTOGIRO
FOR 2.5 c.c. WEBRA OR
SIMILAR—CONTROL LINER
By KARL MULLER
GERMANY
3/32" x 3/8" HARD BALSA SIDE CRUTCH.
3/32" SHEET
1/2" BALSA CENTRE PIECE.
LEAD-OUTS.
DURAL TUBE.
1 1/2" DIA x 1/8" TK PAXALIN.
3/32" DIA ALUM. RIVETS.
18 S.W.G. DURAL 1/4" x 3 3/8"
120°
ROTOR HUB, 1/2 FULL SIZE.
3/32" x 3/16" HARDWOOD.
3/32" SHEET TAIL
LENGTH OF EACH ROTOR BLADE, 9 5/8" CHORD, 2 3/8".
1/2" O/D DURAL TUBE, BOLT TO FORMER 2.
DISTANCE PIECE.
LEAD-OUTS
"⊥" PIECE FROM 18 S.W.G. DURAL
SCALE 1/6 UNLESS OTHERWISE STATED.
3/16" SQ L.E
1/8" x 9/32" SPAR.
1/2" x 3/16" T.E
FULL SIZE ROTOR SECTION, 30 OFF, 1/16" SHEET.

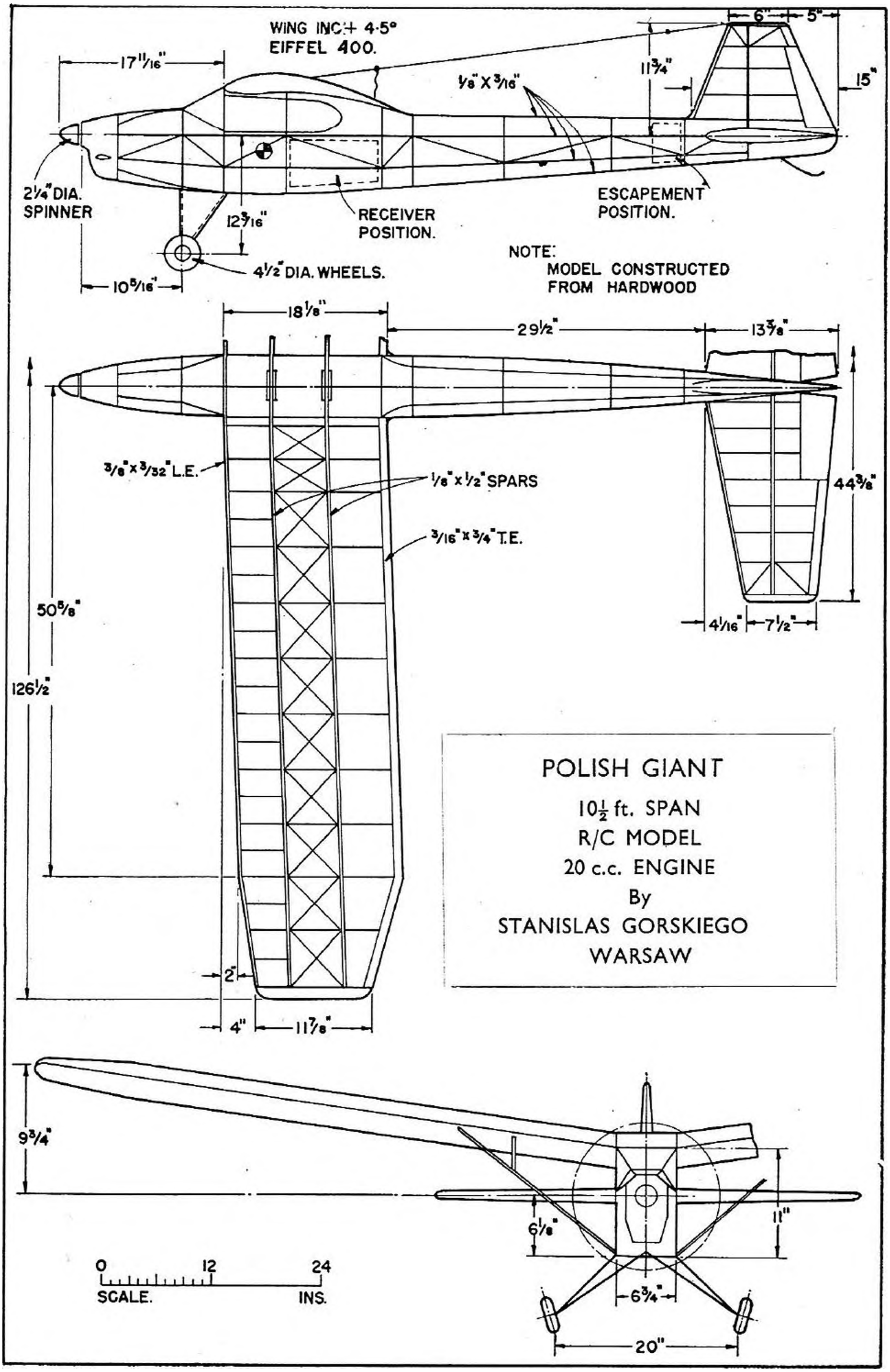


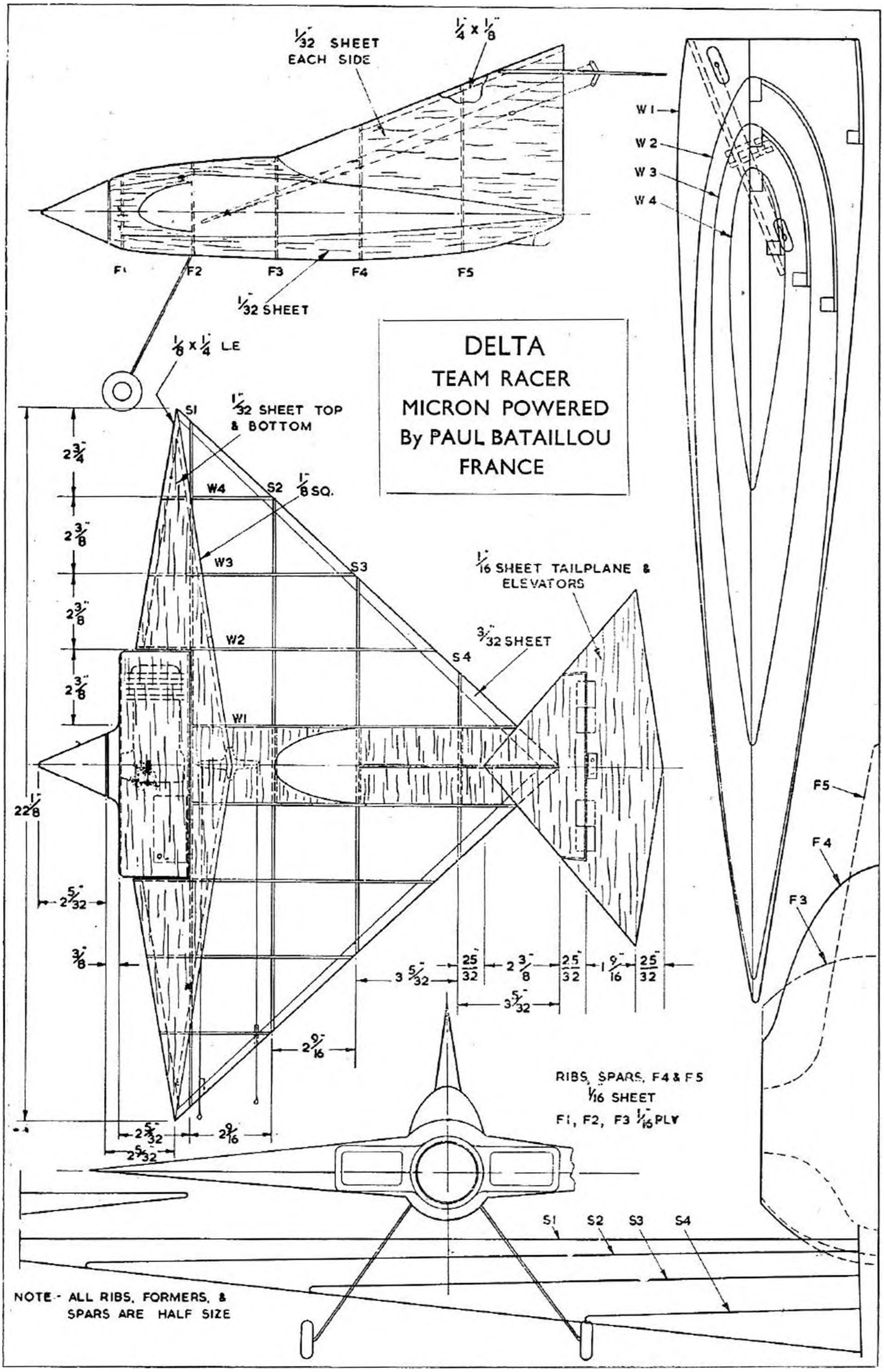
MD-18
SEMI-SCALE
HELICOPTER
By
MUSIKANT DUSKO
JUGOSLAVIA
8 1/4"
9 7/16"
2 3/8"
5" 3 3/32
LOOSE FIT
SMALL RIVETS
18 S.W.G. ALUM'N
HARDWOOD
120°
120°
5/16 I.D. TUBE
45°
ROTOR HUB HALF SIZE
1/16" SHEET
HALF FUSELAGE SECTION HALF SIZE
4 11/32"
2"
18 7/8"
19 11/16"
45°
45°
3/32 x 3/16
1/8" x 3/32"
3/32 x 3/8"
FULL SIZE ROTOR SECTION. ROOT.
TIP SECTION
1/32" SHEET
SCALE UNLESS OTHERWISE STATED IS 1/4" SIZE

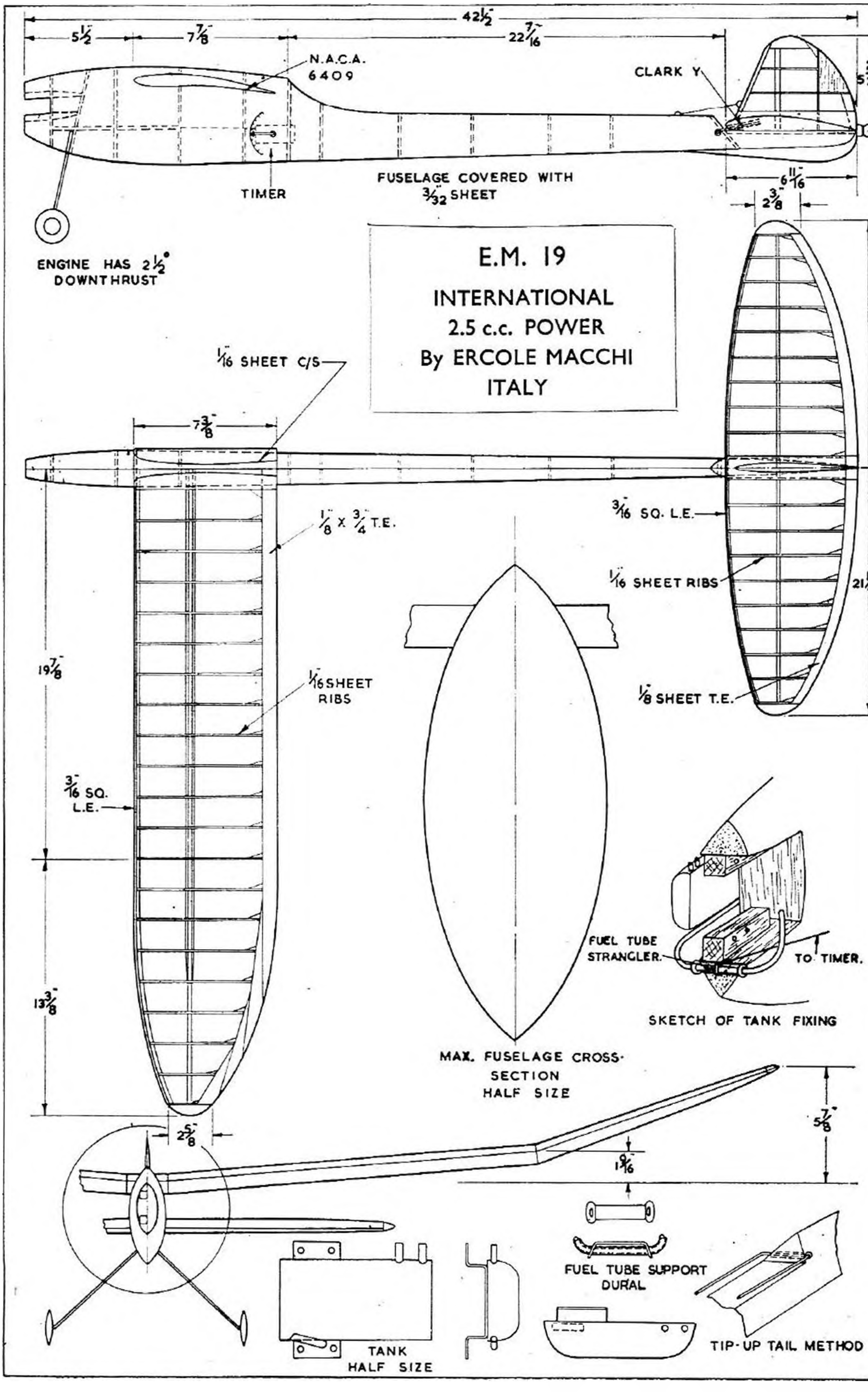

PUSHER CANARD
JAPANESE STICK WATERPLANES
NOTE:- FLOAT DETAIL APPLIES TO BOTH MODELS
16 S.W.G
8 5/8 TRACK BETWEEN INSIDES OF FLOATS
1 3/16 DIHEDRAL
1 9/16 DIHEDRAL
8" PROP.
1/16 SHEET
RIB 'A' HALF SIZE
RIB 'B' HALF SIZE
TRACTOR DESIGN
7/32 TRACK BETWEEN INSIDES OF FLOATS
8 3/4 PROP.
2 3/16 DIHEDRAL

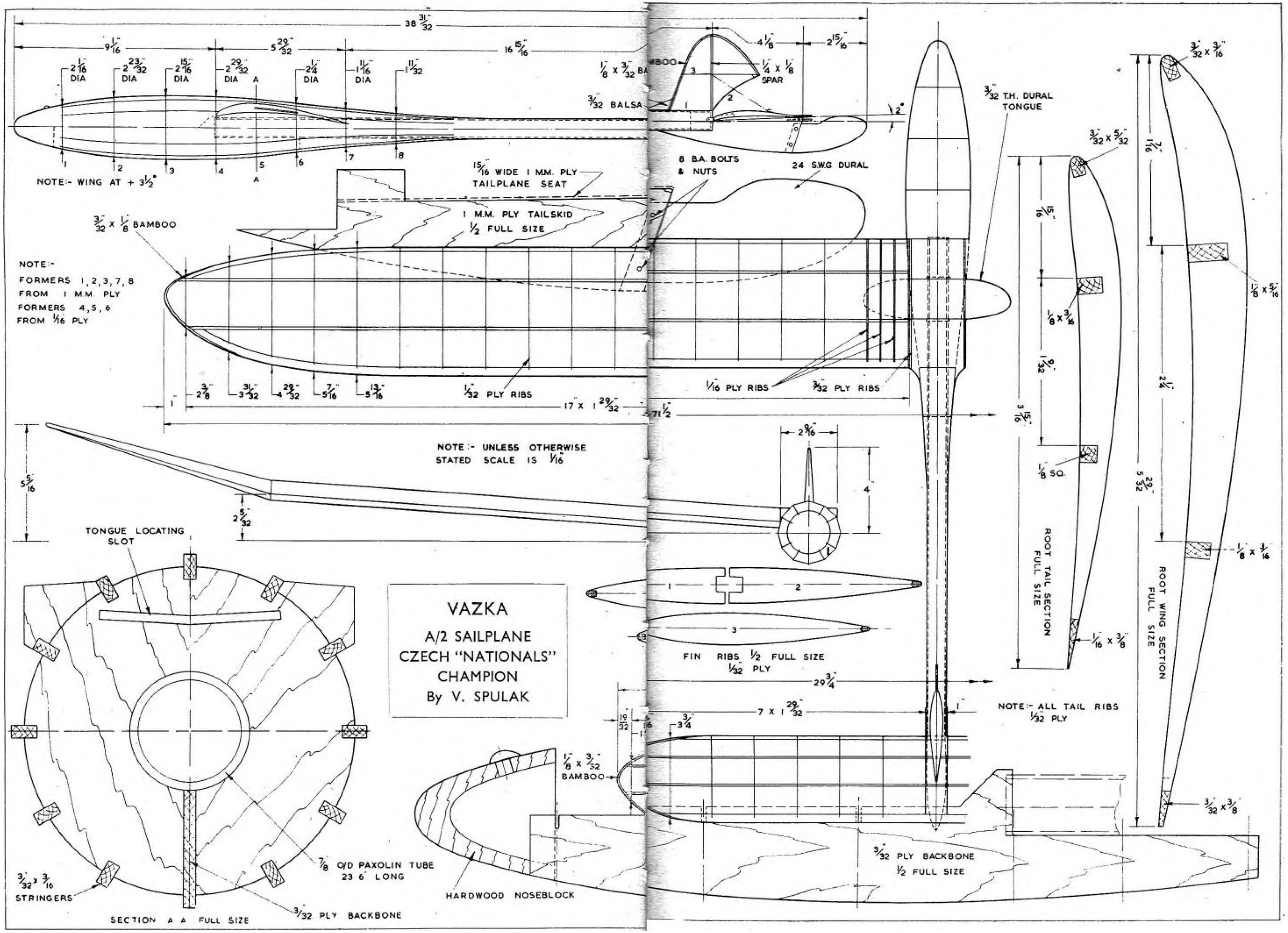

FIN OUTLINE
3/8" x 5/16"
1 3/4"
A
A
BUCKER-JUNGMANN
1½ c.c. CONTROL LINER
By WILLI BECK, GERMANY
7 1/16"
6 1/8"
3 1/8"
TAILPLANE
OUTLINE 3/16" x 5/16"
1/8" x 7/16" T.E.
1 5/16"
1 1/4"
1/4" SQ. L.E.
3/16" x 1/8" SPAR
1/32" SHEET
SECTION 'A-A'
HALF SIZE
1/8" SQ.
1/8" PLY
3/16" SQ.
3/8" SHEET C/S
1/32" SHEET
1 3/8"
1"
5/8"
3 1/4"
1 5/8"
1 5/8"
7/8"
10 5/8"
3 3/4"
NOTE:- DRG. IS 1/4" F.S.
UNLESS OTHERWISE STATED
WING SECTION FULL SIZE
4 3/8"

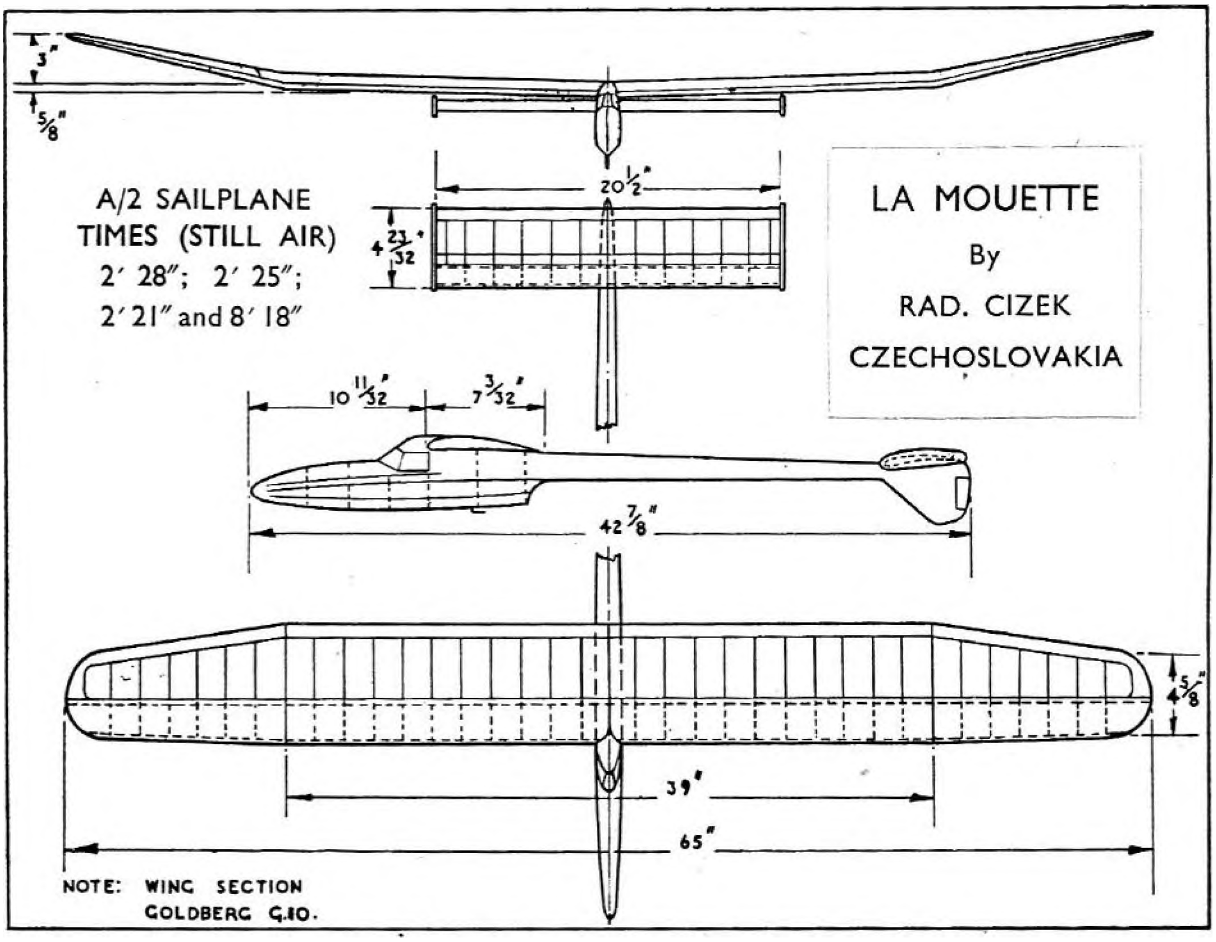

BAMBI
FOR 1—1.5 c.c. DIESELS
By HUBERT LANGER
GERMANY
1/8" x 1/4"
1/8" SH.
1/32" SH. PYLON EACH SIDE.
1/8" SH. FIN.
6"
5"
6 13/16"
3"
1 1/16"
3/16" SQ. LONGERONS.
7/8"
1 7/8"
1/8" SQ.
6"
7 1/2"
1 11/16"
1 1/8"
1/8" X 3/16"
12 S.W.G. U/C. WRAP WITH PAPER. U/C HAS 12" TRACK.
7 5/8"
2 7/16"
2 1/16"
12 3/8"
ALL SPARS. 1/8" X 3/16"
3/16" SQ.
1/8" X 1/4" L.E.
1/8" X 3/16" SPARS.
1/8" SH. L.E.
11 1/2"
11"
2" DIHEDRAL.
1/8" SH. T.E.
4"
5 1/2"
11"
SECTION THRO' PYLON.
TAIL SECTION. HALF SIZE.
WING SECTION. HALF SIZE.
6" DIHEDRAL.

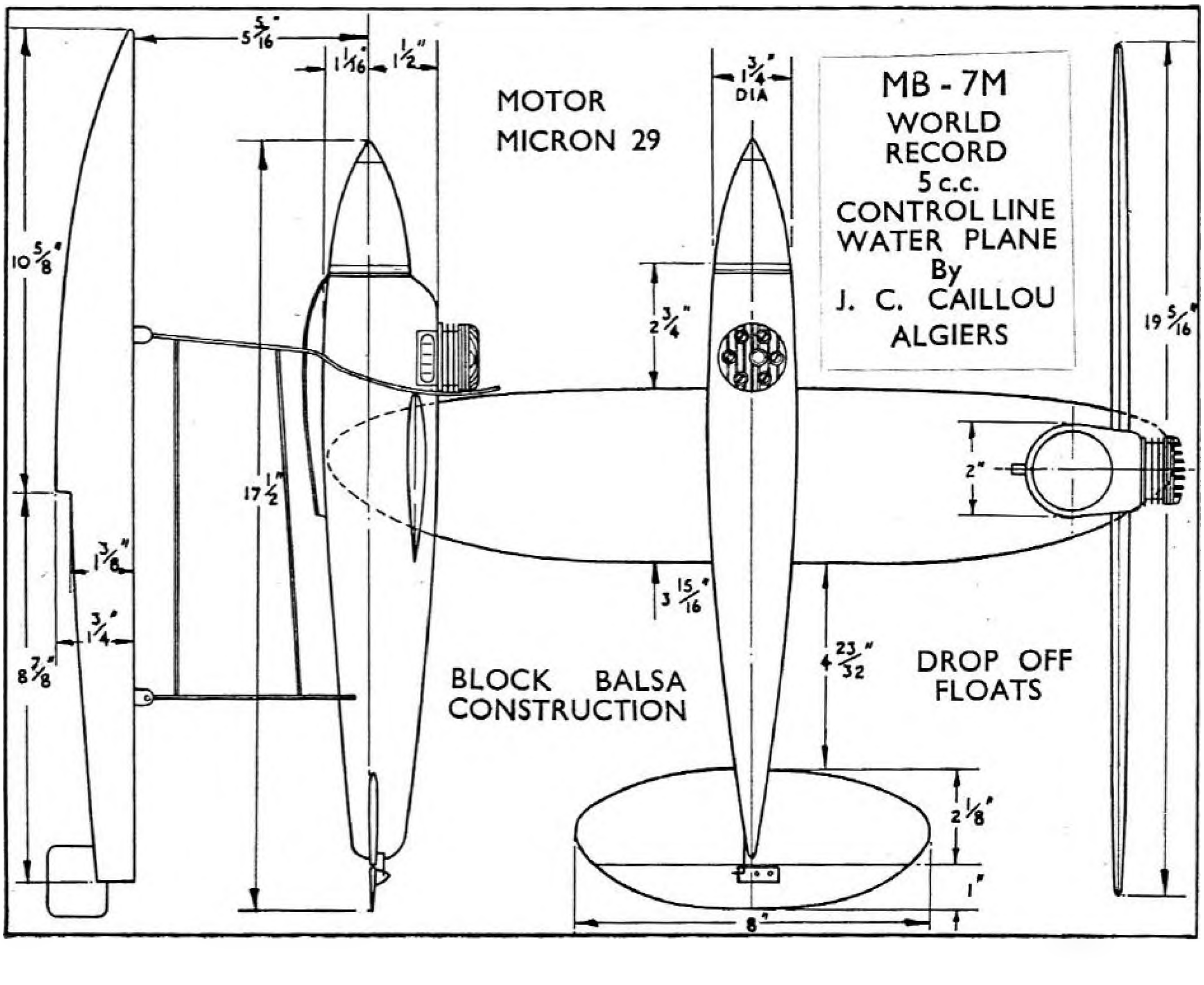

WING INC.+ 4·5°
EIFFEL 400.
17 11/16"
6"
5"
11 3/4"
1/8" X 3/16"
15"
2 1/4" DIA. SPINNER
12 3/16"
RECEIVER POSITION.
ESCAPEMENT POSITION.
4 1/2" DIA. WHEELS.
10 5/16"
NOTE: MODEL CONSTRUCTED FROM HARDWOOD
18 1/8"
29 1/2"
13 7/8"
3/8" X 3/32" L.E.
1/8" X 1/2" SPARS
3/16" X 3/4" T.E.
44 3/8"
4 1/16"
7 1/2"
50 5/8"
126 1/2"
2"
4"
11 7/8"
POLISH GIANT
10½ ft. SPAN
R/C MODEL
20 c.c. ENGINE
By
STANISLAS GORSKIEGO
WARSAW
9 3/4"
6 1/8"
11"
6 3/4"
20"
0 12 24
SCALE. INS.

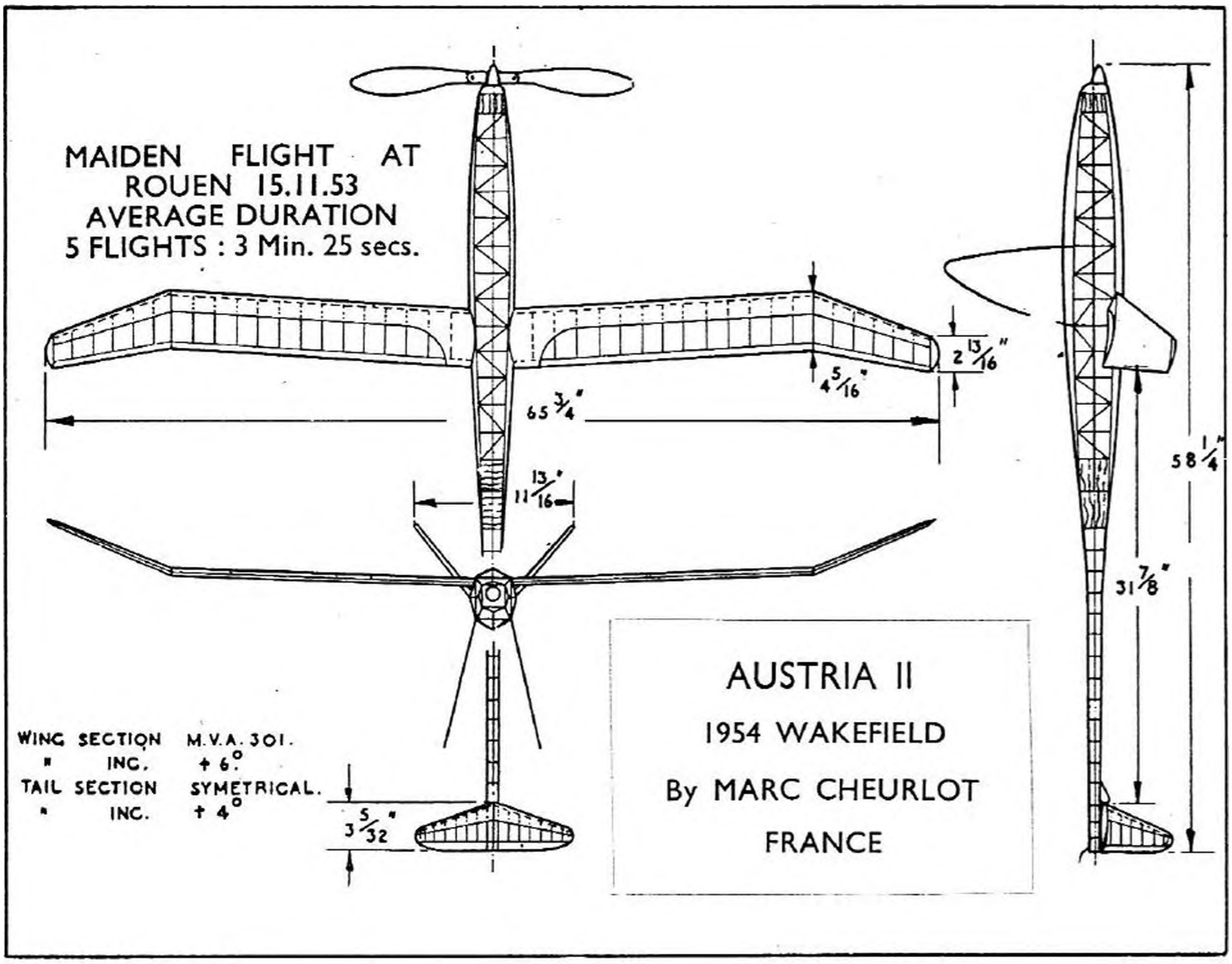

DELTA
TEAM RACER
MICRON POWERED
By PAUL BATAILLOU
FRANCE
1/32" SHEET EACH SIDE
1/4" x 1/8"
1/32" SHEET
1/8" x 1/4" LE
1/32" SHEET TOP & BOTTOM
1/8" SQ.
1/16" SHEET TAILPLANE & ELEVATORS
3/32" SHEET
W1
W2
W3
W4
S1
S2
S3
S4
F1
F2
F3
F4
F5
RIBS, SPARS, F4 & F5 1/16 SHEET
F1, F2, F3 1/16" PLY
NOTE.- ALL RIBS, FORMERS, & SPARS ARE HALF SIZE

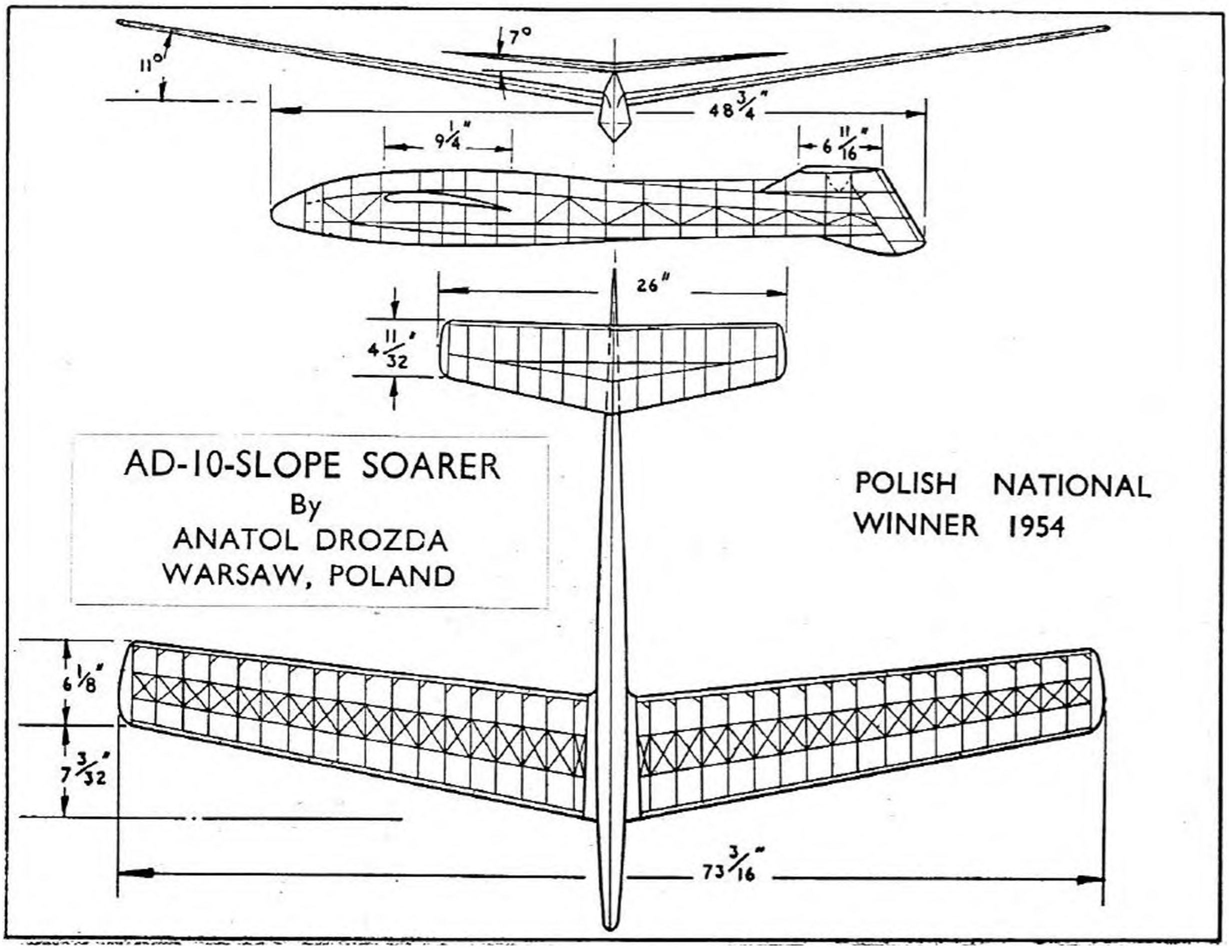

E.M. 19
INTERNATIONAL
2.5 c.c. POWER
By ERCOLE MACCHI
ITALY
42½"
5½"
7⅞"
22 7/16"
N.A.C.A. 6409
CLARK Y
5 29/32
TIMER
FUSELAGE COVERED WITH 3/32" SHEET
6 11/16"
2⅜"
ENGINE HAS 2½° DOWNTHRUST
1/16 SHEET C/S
7⅜"
1/8" x 3/4" T.E.
3/16 SQ. L.E.
1/16 SHEET RIBS
21¼"
19⅞"
1/16 SHEET RIBS
1/8 SHEET T.E.
3/16 SQ. L.E.
13⅜"
FUEL TUBE STRANGLER.
TO TIMER.
SKETCH OF TANK FIXING
MAX. FUSELAGE CROSS-SECTION HALF SIZE
2⅝"
5⅞"
1 9/16
FUEL TUBE SUPPORT DURAL
TANK HALF SIZE
TIP-UP TAIL METHOD

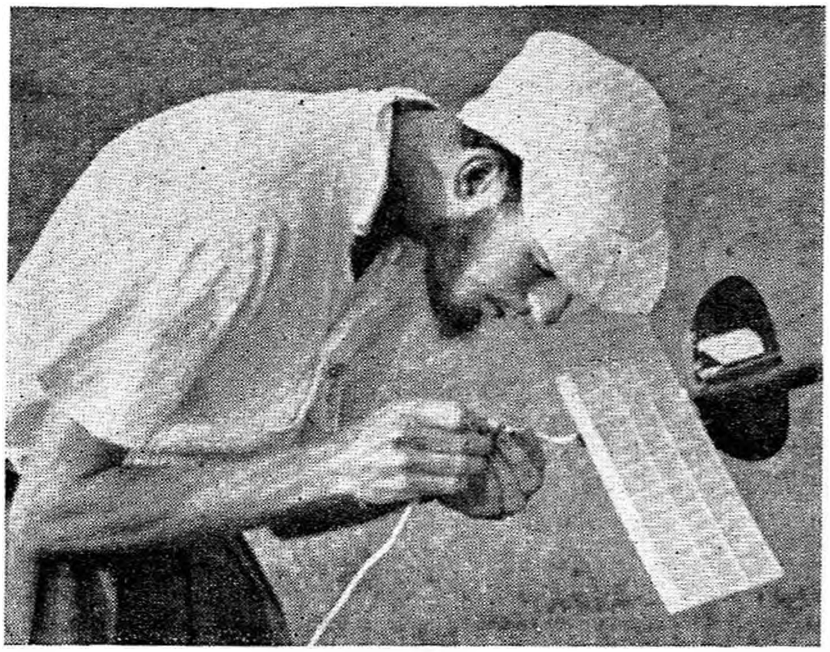

VAZKA
A/2 SAILPLANE
CZECH "NATIONALS"
CHAMPION
By V. SPULAK
NOTE:- WING AT + 3½°
NOTE:-
FORMERS 1, 2, 3, 7, 8
FROM 1 M.M. PLY
FORMERS 4, 5, 6
FROM 1/16 PLY
3/32 x 1/8 BAMBOO
15/16 WIDE 1 M.M. PLY
TAILPLANE SEAT
1 M.M. PLY TAILSKID
½ FULL SIZE
1/32 PLY RIBS
3/32 BALSA
1/4 x 1/8
SPAR
8 B.A. BOLTS
& NUTS
24 S.W.G DURAL
3/32 T.H. DURAL
TONGUE
1/16 PLY RIBS
3/32 PLY RIBS
NOTE:- UNLESS OTHERWISE
STATED SCALE IS 1/16
TONGUE LOCATING
SLOT
FIN RIBS ½ FULL SIZE
1/32 PLY
NOTE:- ALL TAIL RIBS
1/32 PLY
ROOT TAIL SECTION
FULL SIZE
ROOT WING SECTION
FULL SIZE
1/8 SQ.
1/8 x 3/32
BAMBOO
3/32 x 3/16
STRINGERS
7/8 O/D PAXOLIN TUBE
23 6 LONG
3/32 PLY BACKBONE
HARDWOOD NOSEBLOCK
3/32 PLY BACKBONE
½ FULL SIZE
SECTION A A FULL SIZE


A/2 SAILPLANE
TIMES (STILL AIR)
2′ 28″; 2′ 25″;
2′ 21″ and 8′ 18″
LA MOUETTE
By
RAD. CIZEK
CZECHOSLOVAKIA
3″
5/8″
20 1/2″
4 23/32″
10 11/32″
7 3/32″
42 7/8″
4 5/8″
39″
65″
NOTE: WING SECTION
GOLDBERG G.10.


MOTOR
MICRON 29
MB - 7M
WORLD
RECORD
5 c.c.
CONTROL LINE
WATER PLANE
By
J. C. CAILLOU
ALGIERS
5 5/16″
1 1/16
1 1/2″
1 3/4″ DIA
10 5/8″
17 1/2″
2 3/4″
19 5/16″
2″
1 3/8″
1 3/4″
3 15/16″
8 7/8″
4 23/32″
2 1/8″
1″
8″
BLOCK BALSA
CONSTRUCTION
DROP OFF
FLOATS


MAIDEN FLIGHT AT
ROUEN 15.11.53
AVERAGE DURATION
5 FLIGHTS : 3 Min. 25 secs.
65 3/4"
2 13/16"
4 5/16"
13/16" 11 13/16"
58 1/4"
31 7/8"
WING SECTION M.V.A. 301.
" INC. + 6°
TAIL SECTION SYMETRICAL.
" INC. + 4°
3 5/32"
AUSTRIA II
1954 WAKEFIELD
By MARC CHEURLOT
FRANCE


7°
11°
48 3/4"
9 1/4"
6 11/16"
26"
4 11/32"
AD-10-SLOPE SOARER
By
ANATOL DROZDA
WARSAW, POLAND
POLISH NATIONAL
WINNER 1954
6 1/8"
7 3/32"
73 3/16"



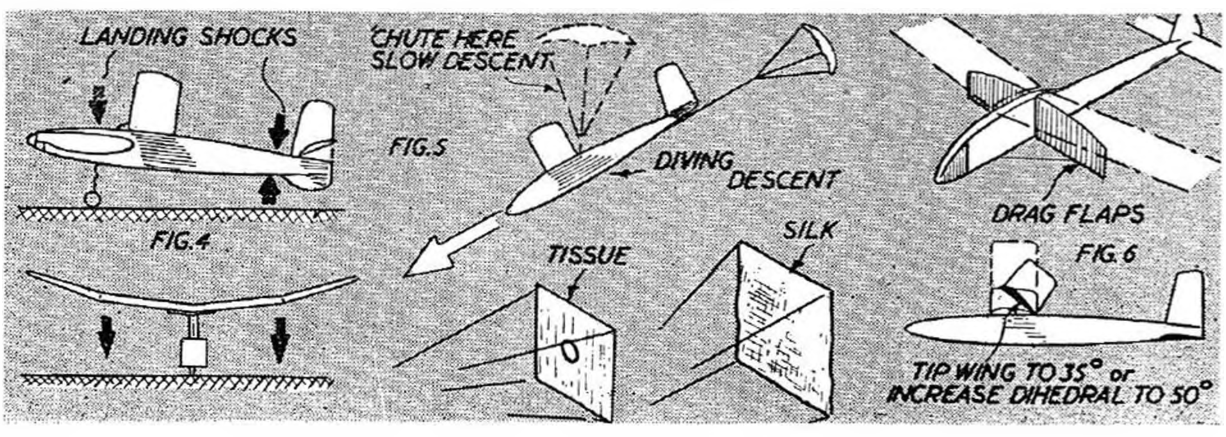
DETHERMALISERS

This shot of Peter Holland carefully lighting his D/T fuse show the approach of the non-smoker to the problem, for he is using his stock of spare fuse as a "slow match"—a tip to remember on contest days.

THE dethermaliser was first introduced as something of a novelty nearly fifteen years ago by past Wakefield winner Dick Korda, of the United States. He employed a timer-operated tab on the fin of a rubber model which tripped over after a pre-determined duration to spin the model down rapidly, thus minimising the risk of a fly-away (and a lost model). Several years elapsed before the first dethermalisers were seen in this country—pioneers in this respect being Norman Lees, Bob Copland, and Ron Warring, all Wakefield fliers.

Today, however, the dethermaliser is regarded as an essential feature of every high-performance free flight model. It is one of those basically simple ideas which have become standard practice; and also an idea of particular merit. Not only does it assist in the recovery of a contest model by limiting flight duration to a reasonable figure (and thus limiting the drift of the model), but it can also be used for "small field" flying, for contest trimming or sports flying. It enables models to be flown, and recovered, in thermal weather—beautiful sunny days when, without a dethermaliser, prudence would dictate leaving the model in the box in case it was lost on a long thermal flight.

The function of a dethermaliser is simple. When operated, it increases the sinking speed of a model. There are numerous ways in which this can be done, but not all offer practical dethermaliser systems. Some do not increase the sinking speed enough, which means that a model caught in a thermal will still go on rising and possibly pass out of sight upwards. Others are rather too drastic



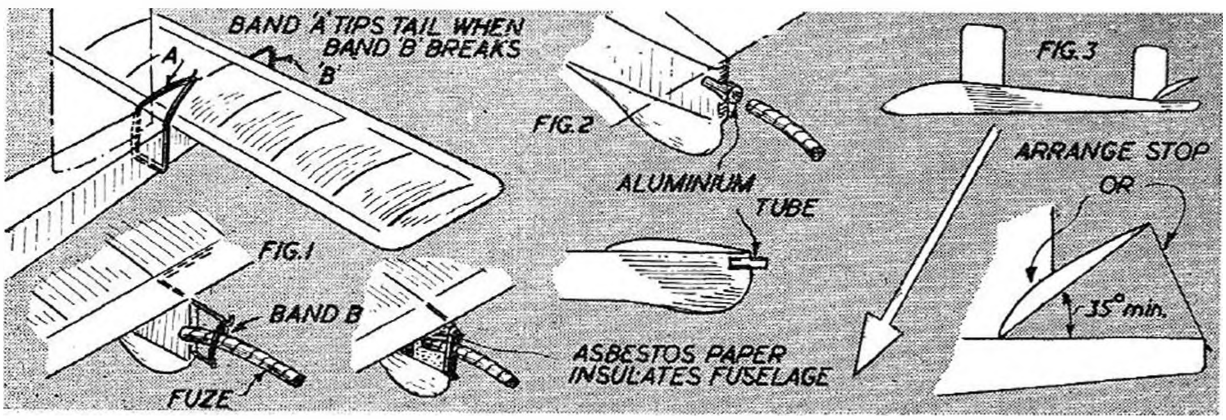
in action, so that the model may sink rapidly to penetrate the thermal, but suffer damage on striking the ground. The ideal practical system offers a compromise between an adequate sinking speed and a safe landing.

An "adequate" sinking speed does not mean one which will bring a model down through *every* thermal. Some upcurrents are strong enough to carry a light model upwards even if it shed its wings! But such thermals are the exception rather than the rule. Modern dethermalisers are suitable for coping with most normal conditions, and even if the model does still continue to rise in an area of strong lift, be sure that its eventual descent will be quicker due to the dethermaliser. Contrary to quoted reports, a model cannot do other than sink faster *through the air*, once dethermalised.

A dethermaliser system consists of two main features—the dethermaliser itself, which increases the sinking speed of the model, and a method of tripping or "timing." Any form of mechanical or pneumatic timer can be adapted for the latter purpose, but a clockwork mechanism tends to be too heavy and a pneumatic timer too critical on adjustment (and rather unreliable over long settings). By far and away the most popular type of timer is the burning fuze. Despite its apparent and obvious limitations, such as the fire hazard (both to the model to which it is attached and to inflammable material on which the burning fuze may eventually drop), the fuse is virtually the universal "timer" for all types of dethermalisers on all sizes of models.

Over the years all sorts of strings and wicks have been tried and tested as fuses. Ordinary round cotton lampwick, about 3/16 to ¼ inch in diameter is excellent, without further treatment. Once lighted it smoulders and burns steadily, at a uniform rate equivalent to about one inch consumed per ninety seconds. Rate of burning is little affected by atmospheric conditions, except that it may, but not inevitably, be extinguished in heavy rain. About the next best fuse material is "butchers' string" of 1/8-in. diameter soaked in a saturated solution of salt petre and then thoroughly dried. This burns at the rate of about 75 seconds per inch and is very difficult to put out. Thinner, open wound strings, treated or untreated, are less reliable and tend to be inconsistent. The above two types of fuse cover all normal requirements. Also, despite the apparent crudity of the system, timing can be quite accurate by adjusting the length of fuse used. Experience should enable the user to get within ten seconds of any required setting, which is quite accurate enough for dethermalising purposes.

Fire hazard to the model can be eliminated quite simply by arranging that the fuse cannot contact any part of the model, other than wire fittings and the hold-down band, or by insulating that part of the model against which the fuse



rests with a small piece of asbestos paper (*e.g.*, as supplied in Jetex motor kits)—Fig. 1. However, the fuse on burning through the hold-down band is thrown off as the band snaps, the burning end falling to the ground. This can present another fire hazard and it is strongly recommended that all fuse-operated dethermaliser systems should incorporate a device which *retains* the fuse end on the model and snuffs it out.

This is very simple to arrange. A short length of aluminium tube is mounted in the model, into which one end of the fuse is slipped. The fuse should fit tightly enough so that it will not fall out when unsupported by the rubber band—Fig. 2. This tube acts as a "snuffer." When the dethermaliser is tripped the fuse end remains in the tube. On burning down to the end of the tube it is automatically extinguished. The extra work involved in making such a fitting is small and it is a pity that it is not more widely adopted—or even made obligatory.

As to the dethermaliser itself, although there are many methods of producing a satisfactory sinking speed with a reasonable "landing," the tip-tail system is by far and away the best for most models. In this the tailplane is so fixed that when released by the "timer "the trailing edge pops up to give the whole tailplane an exaggerated negative incidence. The actual angle is important since this governs the rate of sink. If less than about 15 degrees, the result may be nothing more than putting the model into a series of sharp stalls. At a higher negative angle, however, the model simply sinks straight downwards on an even keel, giving a reasonable landing approach where the shock, wholly or partially, can be absorbed by the landing gear. The higher the angle of tip the greater the sinking speed. A *minimum* of 35 degrees is advised to produce an *adequate* sinking speed. Much higher angles are unnecessary.

Tip-tail dethermalisers work well on orthodox model layouts in all sizes. There are, however, one or two points to watch. The point of touch-down may be the extreme rear of the fuselage, or underfin—Fig. 4—which may break the rear of the fuselage, if this is too weak. Strengthening of the fuselage in this region, or having a plug-in rear unit which can be knocked off, are practical solutions.

The undercarriage also receives a sharp upward loading on striking the ground and should be reasonably flexible in this direction to avoid transmitting this load direct to the fuselage. With large, heavy models, too, one-piece wings receive a sharp downward loading, sufficient in some cases to split the upper surface covering. Most of these hazards can be overcome, or minimised, and are a relatively small price to pay for getting the model down safely under control.

Tip-tail dethermalisers do not work well on long fuselage models with a small tailplane area. The effect, generally, is to put the model into a series of stalls, building up into close loops. In some cases tail-tipping can be employed by arranging for the tailplane to *tilt* at the same time as it tips. This will put the model into a spin. More often, however, such models are seen with a parachute dethermaliser.

Parachute dethermalisers are the "second choice." A parachute of suitable dimensions is stowed in the fuselage (or merely strapped alongside the fuselage), released by the timer. It then streams out downwind, adding drag and forcing the model into a dive. Both the size of the 'chute and the material from which it is made affect the drag produced; whilst the point to which the 'chute line is attached governs the attitude of the model during descent.

Thin silk or nylon parachutes are best from the point of view of durability and ease of stowage without creasing. Tissue 'chutes are employed on lightweight models (mostly strapped to the outside of the model rather than stowed internally). For the same effect, a silk 'chute must be larger than a tissue 'chute, with nylon offering an intermediate size.

Plain squares of material make adequate braking 'chutes, with a single cotton or thread line attached to each corner. Tissue 'chutes normally have a vent cut in the centre to spill air and prevent the 'chute from oscillating. Textile materials are porous enough to prevent this happening without venting.

The size of 'chute required depends on the size and weight of the model, also the angle of descent which can be tolerated. A common fault is to make the 'chute too small, when the descent is "safe," but the sinking speed far too low for even average requirements. Best size for individual models should be determined by experiment, starting with an area of about three-quarters of the wing area for textile materials and about one-half of this for tissue 'chutes. Attaching the 'chute near the rear of the fuselage will give the strongest "diving" effect.

The landing with a 'chute dethermaliser is quite different to a tip-tail descent. The model does, in effect, dive into the ground, which is apt to be hard on non-folding propellers and the fuselage (particularly on "long" models). In many cases, however, the 'chute-type dethermaliser is the most satisfactory solution, as in the case of models with the tail-plane strapped *underneath* the fuselage. Models of this type *are* made with tip-tail dethermalisers, the leading edge of the tailplane tipping *down* and the whole tailplane pivoting about its trailing edge. This arrangement lacks the simplicity and positive fixing of the normal tip-tail installation and the tailplane itself now strikes the ground first. It is usually confined to relatively light models.

The tip-tail and 'chute dethermalisers will cover most needs. Of the numerous other schemes which have been tried, only three will be described as possible alternatives for special cases—Fig. 6. The tip-wing action produces a positive dethermalised descent, angle limits being similar to that described for the tip-tail unit. It is rather more difficult to rig than the tip-tail, and still get a positive, unalterable seating for the wing for normal flying. The same argument can be levelled against the second type, which relies on increasing the dihedral angle of the wings to some 40 to 45 degrees. This is positive in action, gives a "safe" descent, but presents mechanical snags.

Drag flaps, opening out from the fuselage as air brakes or from the wings as spoilers are ineffective unless of very large area. They can work quite well *if* they are big enough, but for similar effect need to approach the area of an equivalent tissue brake parachute. Flush seating of these brakes or spoilers during normal flight is also something of a problem.

Any modeller who has lost a good model in a thermal will appreciate the need for a dethermaliser. It should be an unvarying rule that any new model with "duration" possibilities should incorporate such a device. Keep the "timing" unit as simple as possible and get into the habit of using a fuse each flight, especially when flying during the morning or afternoon. Thermals or upcurrents can be present in the most unlikely weather—even when it is raining. And once you have got into the habit of "timing" your flights in this fashion you will find it a simple matter to bring a model down within the limits of your flying field. Dethermalisers are not just contest accessories—they are useful on any type of free flight model.


WN347
N347
WD933
D933
VX181
WM166
WM166
166
C. RUPERT MOORE

POST-WAR BRITISH CAMOUFLAGE

By C. Rupert Moore, A.R.C.A.

THE colour schemes of aircraft in use today by the Royal Air Force are either the continuation of the use of "Shadow Shading" first introduced in 1937, and modified periodically ever since, or a return to the livery of the 1923-37 period.

This is my excuse for painting the frontispiece which shows Spitfires of 19 Fighter Squadron in full "official" Battle of British colours.

At the beginning of the Battle, few Spitfires seen over North London were so camouflaged on their under surfaces, most I saw had the port wing black and the starboard very pale grey, reminiscent of the Battle of France but that probably was local.

The episode depicted took place on 7th September, when Spitfires stationed at Duxford were called upon to help guard North Weald aerodrome which was believed to be the intended target of the Huns, as it happened, to quote the official history—"the Arsenal and other industrial targets in Woolwich" were attacked and "the Luftwaffe took a fierce drubbing from the Duxford and Northolt pilots. Three aircraft of 19 Squadron are seen peeling off to the attack, I chose QV-I as it is a good example. Top surfaces and flanks are "shadow shaded" DARK EARTH with DARK GREEN, under surfaces are, what was loosely called "duck egg blue" the correct name being SKY of course. The international markings were bright Vermilion, White and ultramarine. It was not until later that the colours were changed to the dull Indian Red, narrow band of white and Indigo. The fuselage roundel was surrounded by a broad circle of Cadmium Yellow. The spinner of QV-I was regulation Black. The squadron letters were Pale Grey and the serial number X 4474 Black. The serial letter X may surprise some readers as it is generally supposed that no Mark I Spitfire had a serial letter beyond P. There were at least two X serials and one R in 19 Squadron at this date, QV-H was X ??44, QV-K was P.9386 and the R number of R.9874.

It is interesting to note that the spinner of QV-K, the centre aircraft was white, this, of course, became standard at a later date.

During the last war there were twenty seven colours specified by the Navy and Royal Air Force though I must confess I never saw four of them in use. Since 1948 I have identified fourteen. As most of the "neutral" colours defy verbal description I have carefully selected the examples to illustrate, in order to show all the indescribable colours. Such names as Dark Earth or Dark Green have no meaning, earth can be anything from white chalk to the red clay which masquerades as earth in my garden! There are colours which are definite such as black, white, aluminium, Ultramarine, Vermilion, Indian Red, etc. The only reliable and constant colour is that prepared by artists' colour men. All local agents have a colour chart for *artists water colour* and it is to this I refer you should you wish to have a complete understanding of the subject. While I remember, avoid poster colour charts as they are far from constant.

INTERNATIONAL INSIGNIA

It will be understood that all R.A.F. and Naval types must carry international insignia. From 1942 until 1948 the wartime indigo, white and Indian

Red with narrow white was used for both roundels and fin flashes, the roundel on the fuselage being outlined yellow. P.R.U. and Fighter Aircraft had the white added to roundels above the wing tips after the war. In 1948 a new ruling for both colour and proportions was introduced, the colour was changed from Indian Red to an equal mixture of Vermilion and Crimson Lake, (for brevity I shall refer to it as VERMILION). WHITE and pure ULTRAMARINE. The proportion of the roundels is a series of circles having a radius of:—

RED 1 unit; WHITE 2 units; BLUE 3 units (*see illustration*).

Thus the red centre is twice the diameter of the width of the white or blue bands. Fin flashes revert to a square of 24 in. divided into three equal Red, White and Blue vertical striped, (Red always leading (*see illustration*)).

R.A.F. aircraft roundels on the upper surface of each wing are as large as possible but limited to a maximum diameter of 7 feet. Roundels are not allowed to encroach on control surfaces. Roundels are painted on both sides of the fuselage, and below the wing tips except on Photographic Reconnaissance Unit aircraft, Night Fighters, Bombers and Coastal Command aircraft which have no roundel under the wing tip.

NAVAL AIRCRAFT have roundels of 3 feet diameter or less where space does not permit, above and below the wing tips and on the fuselage, NO FIN FLASHES are now used by the Navy (since 1948).

IDENTIFICATION LETTERS AND SERIAL NUMBERS are painted on each side of the fuselage near the tail and below each wing tip on all British aircraft. The wing identification reads from the roundel inwards the letter being next to the roundel, thus the numbers are inverted in relation to each other.

Black letters are used on light coloured wings and white on dark ones. The words ROYAL NAVY are painted above serial numbers on the tail of Naval aircraft.

BASIC COLOUR SCHEMES

All aircraft are now doped glossy to improve performance, during the last war matt surfaces were the rule. Airscrews, where used, are Black with TRAINER YELLOW tips.

My illustration gives top view, underneath view and side view of three aircraft, the top one WN 347 representing the ROYAL NAVY, is a Fairey Gannet, the centre one, WD 933 is a Canberra night bomber of Bomber Command, the bottom one WM 166 is a Gloster Meteor NF 11 Night Fighter. The wing tip XV 181 is a Photo Reconnaissance Unit Canberra the one which won fame by flying to Australia last year in 22 hours. These are all real aircraft examined by myself at close quarters, the colours and basic pattern (the latter being slightly adjusted to suit different types) are used on all other types performing similar duties.

THE NAVY (*represented by the Gannet WN* 347).

Since 1948 all front line Naval aircraft are EXTRA DARK SEA GREY on top surfaces and SKY on flar nd under surfaces. Spinner and airscrew are black with YELLOW tips. S lron identifications are frequently to be seen pained on both sides of the tc d the fin and a large sized number painted on both sides of the fuselage in . Gannets so far have not appeared thus identified and one might have pr ed that they ultimately would have done so, until one was faced with the complete squadron of Sea Hawks of 804 Squadron at the recent Naval Air Day at the Royal Naval Air Station Bawdy, none of which had these identifications. Three serial numbers of these Sea Hawks are WF 202, WF 208 and WF 211.

Here are several aircraft types camouflaged as my illustration with their special identification included:—

Fairey Firefly 6, Serial number WD 917, FD on fin, large 203 aft of roundel; Sea Hornet VX 486, Q on fin, 486 aft of roundel; Sea Fury VX 659, CW on fin, 135 aft of roundel.

NAVAL TRAINING AIRCRAFT are aluminium doped all over with Yellow "Trainer Bands" (see R.A.F. trainers).

NAVAL COMMUNICATIONS TYPES are aluminium doped or bare bright metal all over.

This ruling applies to helicopters thus Westland Sikorsky S 55 helicopters, as used by the Duke of Edinburgh from Buckingham Palace, are coloured as front line aircraft, Extra Dark Sea Grey and SKY with rotor blades black, tipped with Cadmium Yellow. Saunders Roe Skeeters appear as communication types aluminium all over. A ruling was made dated May, 1946, which was in force, with the possible modification of the roundels, until the scheme described above was introduced in 1948. A Sea Fury number VB 857 appeared in exactly the same colours but with flanks, rudder and fin treated as top surfaces and doped EXTRA DARK SEA GREY down to a level of the trailing edge of the wing. Wartime 1942 type and colour roundels being used *complete with fin flash.* This was typical of "Firebrands" and other types of the period.

BOMBER COMMAND. The centre aircraft WD 933 is a typical bomber scheme, upper surface being MEDIUM SEA GREY including rudder and fin, under surfaces and flanks glossy Black. The Black extends to a straight line from the leading edge of the tailplane to a point one inch above the highest point of the wing and then on to the cockpit and over the top of the nose—All serial letters are in White. No roundels are carried below the wing tips. One exception to this rule is VX 185 which is the Canberra Mark 5 which held the double crossing of the Atlantic record, this aircraft also had a narrow white ring encircling the nose and tail cone.

Just before the end of the last war, bomber aircraft preparing for the assault on Japan appeared doped white on all upper surfaces and flanks and black below. International markings were as Canberra WD 933. This scheme persisted and I saw a Lancaster TW 669 thus, as late as October 1948. Lincolns also appeared in this scheme but by 1950 were as the Canberra. The Lincoln, serial RF 350 appeared as WD 933 with fuselage serial and squadron letters SN-L in INDIAN RED. Washingtons (*i.e.* R.A.F. Superforts) were natural aluminium with 1948 insignia and black letters.

COASTAL COMMAND. Upper surfaces are MEDIUM SEA GREY and under surfaces WHITE including both sides of each rudder, fin and the whole of the flanks (flash is also both sides of fins). White is carried over the leading edges of wings, and tailplane so that the aircraft appears white from below. Very pale grey serial is painted on the fuselage. A Lancaster in this scheme was seen in August, 1951, with a large C left and B right of each fuselage roundel in pale grey. Shackleton WB 822 appeared thus with wing serials black. Certain coastal types have Medium Sea Grey spinners.

PHOTOGRAPHIC RECONNAISANCE UNIT (P.R.U.)

The wing tip VX 181 gives a sample of colour which can only be described very inaccurately as a dull turquoise blue. P.R.U. aircraft have been doped all over P.R.U. Blue consistently since the middle of the last war. Insignia are as on WD 933. In 1950 a Spitfire 19 and a Mosquito 34 (sorry I could not get their serials) were seen with Squadron letters WY-R and DH-T respectively in White. A very "unregulation" P.R.U. Canberra was seen in 1953, P.R.U. BLUE below and flanks and shadow shaded LIGHT SLATE and SKY GREY above!

DAY FIGHTERS are aluminium doped all over as glossy as possible with roundels above and below wing tip and on fuselage sides. Fin flashes are regulation. The usual serial numbers are black.

FIGHTER SQUADRON MARKINGS. In 1950 the reintroduction of peace-time 1923-37 squadron markings began to appear on Day Fighter and Meteors, it was not, however, until 1952 that the fact was publicly released. These markings took the form of a long rectangle about half the depth of the fuselage roundel (or more) and about three times the diameter in length. This appeared to run behind the roundel and is illustrated just below the tail of Canberra WD 933 side view. This is in fact the squadron mark of 23 squadron and is used on camouflaged Night Fighter Vampires, the serials of three of which are WP 255, WP 256 and WM 730. The following are some of the markings:—

No. 1 Sq. White rectangle outlined red; No. 17 two parallel Black zig-zags; No. 19 Blue and White Chequer; No. 25 White rectangle outlined Black; No. 29 Red crossed between two red lines; No. 41 Red rectangle lined top and bottom White; No. 43 White and Black chequer; No. 54 Blue and Yellow chequer; No. 56 White and Red chequer; No. 85 Red and black chequer; No. 245 Blue and Yellow chequer; No. 257 Green and Yellow chequer; No. 600 rectangle formed of alternate inverted triangles, top row white, bottom vermilion; No. 601 same, Black and Red; No. 604 same, Yellow and Red. Meteor 8's of 66 Squadron have a white rectangle outlined Ultramarine, each aircraft having an individual letter on the fin below the tail in Black, thus:—aircraft VZ 463 has a letter B; WF 655 letter E; WA 850—F, WA 998 letter G; WF 715—H; and WA 816—S.

These Meteors are of course aluminium doped all over.

NIGHT FIGHTERS. The bottom aircraft WM 166 is a Meteor NF 11 and is shadow shaded DARK GREEN with MEDIUM SEA GREY. As the under surface is also MEDIUM SEA GREY there is no definition between top and bottom where grey meets grey. The green comes down to the centre line of the fuselage. Roundels are not carried below the wing tips. Serial numbers of the usual type are Black. Spinners (if any) are Medium Sea Grey. A De Havilland Venom Mk. 2 night fighter thus camouflaged had WL 808 serial. The latest information to be released is of the Meteor NF 14's of 85 Squadron, these aircraft are camouflaged as WM 166 and have the Vermilion and Black chequer markings. The following are three serial numbers:—

WS 729, WS 737, WS 782.

A.O.P. AIRCRAFT (Air Observation Post)

These aircraft, chiefly Austers are the only ones to be shadow shaded all over, on bottom surfaces as well as top. In peace time they carry the usual disposition of serial numbers in White with roundels under wing tips as well as on top and with fin flashes. Auster VF 622 carried White Squadron letters of TS-U. A.O.P. Helicopters conform to this rule, Bristol Scyamores are shadow shaded as above with usual fuselage roundels, Black rotor with TRAINER YELLOW tips. Samples of these colours are given in the overlapping rectangles just below the P.R.U. Canberra Wing Tip VX 181.

TRAINERS are either aluminium doped all over or are left bare metal. Regulation insignia appear above and below wings and on fuselage together with Fin flash. The same disposition of serial numbers is used. Broad bands of TRAINER YELLOW encircle the fuselage aft of the roundel and the wings (in a fore and aft direction) halfway between roundels and wing roots. These bands are kept clear of wing flaps.

The Navy's Trainers are the same, *without a fin flash*. A Canberra Trainer Mk. IV, number WN 467 is treated thus with the addition of rudder and fin all doped yellow. A Percival Prentice VR 306 in the same livery had Squadron letters in Black FC - LG the rear two letters superimposed on the yellow band. Soon after the war ended until 1948, Trainers had the habit of appearing doped entirely yellow all over with regulation insignia and serials. Two Percival Prentices thus were VR 109 and VR 191 (*see November*, 1947 AEROMODELLER *cover*).

COMMUNICATION AIRCRAFT

These aircraft are either doped aluminium or left bare metal.

Three Ansons seen at Hendon in July 1951, were aluminium doped with Vermilion white and Ultramarine roundels and flashes. Roundels appear below wings with the usual black serial letters and numbers. TX 239 had squadron letters CB-C WM 390 had CB-L painted in Vermilion, TX 195 had no squadron letters. Handley Page "Hastings" have a personal touch in the form of an Ultramarine flash from nose to tail with the fuselage roundel superimposed. Three black squadron letters are pointed immediately aft of the roundel also superimposed. A three figure number is also painted just above the flash on the fin. Aircraft JAF is numbered 568; JAH—564 and GAB 614. In 1951 several Hastings were seen doped extra Dark Sea Grey down to the level of the chord line from leading to trailing edges of the wings and were pale grey (just off white) below. The usual insignia were used with usual serials. A very pretty and highly polished D.H. Devon for Very Important People lived also at Hendon. It looked like burnished silver with a glossy broad Ultramarine flash along the fuselage. Above this was dazzling White. The appropriate serial was VP 913. The tale goes that short service R.A.F. types were kept so busy polishing that one went right through and it had to be reskinned!

TARGET TOWING AIRCRAFT are as Trainers with diagonal black bands on under surfaces only these run at 60° as seen from underneath, they go from North East to South West, the nose representing North. The black is about 36 inches broad and there is space for two such bands between them. The key line is centred with the N.E. roundel. Space is left for serial numbers. The fixed tail plane is also black.

INDIVIDUAL TYPES

Since a number of prototypes appearing at Farnborough were not orthodox colours I propose to give a few notes on them.

In 1950 the HAWKER 1081 serial VX 279 was doped SKY all over with roundels but no fin flash—serial in Black, a Yellow P encircled by circle denoting prototype on tail end of fuselage.

In 1951 the SHORT SA/4 Four jet bomber was Medium Sea Grey all over except for the belly which was Black below the centre line with a complicated flash of 2 in. lines at this junction starting at the top Black, Grey, Vermilion and Grey. Roundels appeared but no fin flash.
BOULTON AND PAUL 111 Delta, VT 935 aluminium doped in 1951; a Primrose Yellow, with black flash in 1953. R.A.F. roundels and fin flash—Black serial number.

In 1952 the SUPER MARINE SWIFTS, WK 194 and WJ 960 appeared in modern Day Fighter livery. Serial numbers were parallel to the leading edge of wing (*i.e.* Swept). The fin flash is also swept.
HAWKER HUNTERS, FMR1—WB 195 and WB 188. Sky all over—Insignia roundels flash and serials as Swift above.

AVRO DELTAS, 1952 and 1953.

AVRO 707A, serial WD 280—Scarlet all over (equal parts of Vermilion and Crimson). R.A.F. roundels and "swept" fin flash—Wing serials below, parallel to trailing edge in Black.

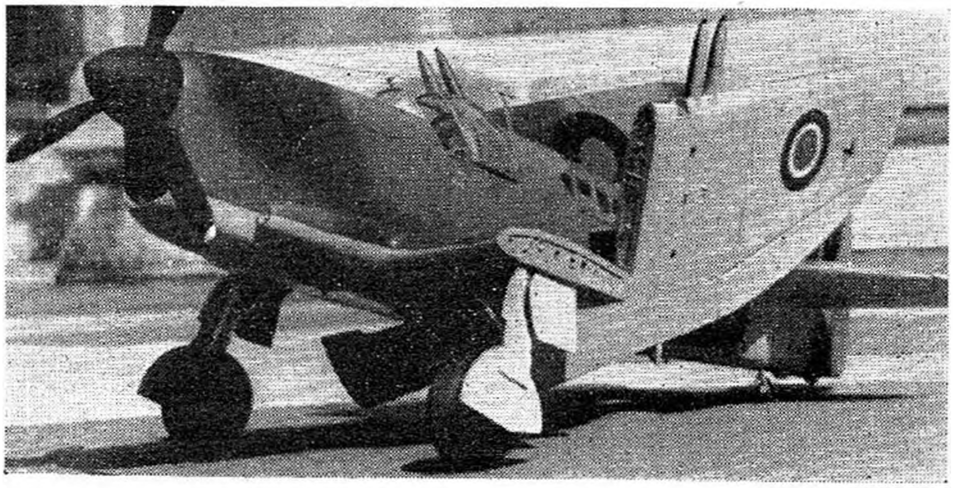
AVRO 707B, serial VX 790—Azure all over (equal parts of White and Ultramarine) Insignia and serials as 707A.

AVRO 707C, serial WZ 744—Pale Chrome all over. Insignia and serials as 707A. This aircraft appeared at the 1953 Farnborough display.

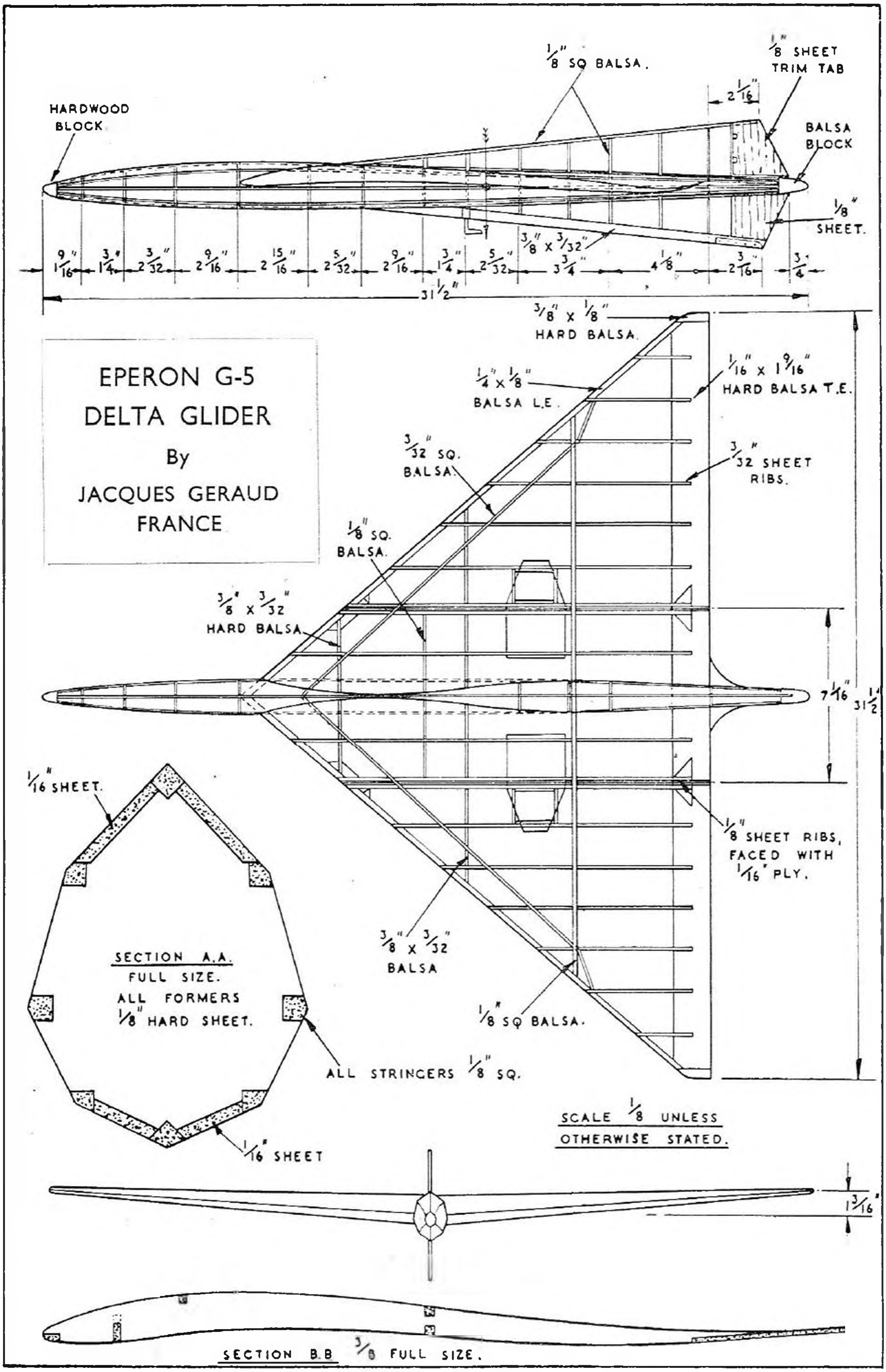
AVRO "VULCAN," serial VX 770—White all over with roundels above and below wings and "swept" fin flash. Serial numbers below wings are in a straight line between roundels at right angles to centre line of fuselage and are in Black.
AVRO "VULCAN," serial VX 777 (Farnborough 1953)—similar to VX 770 above.

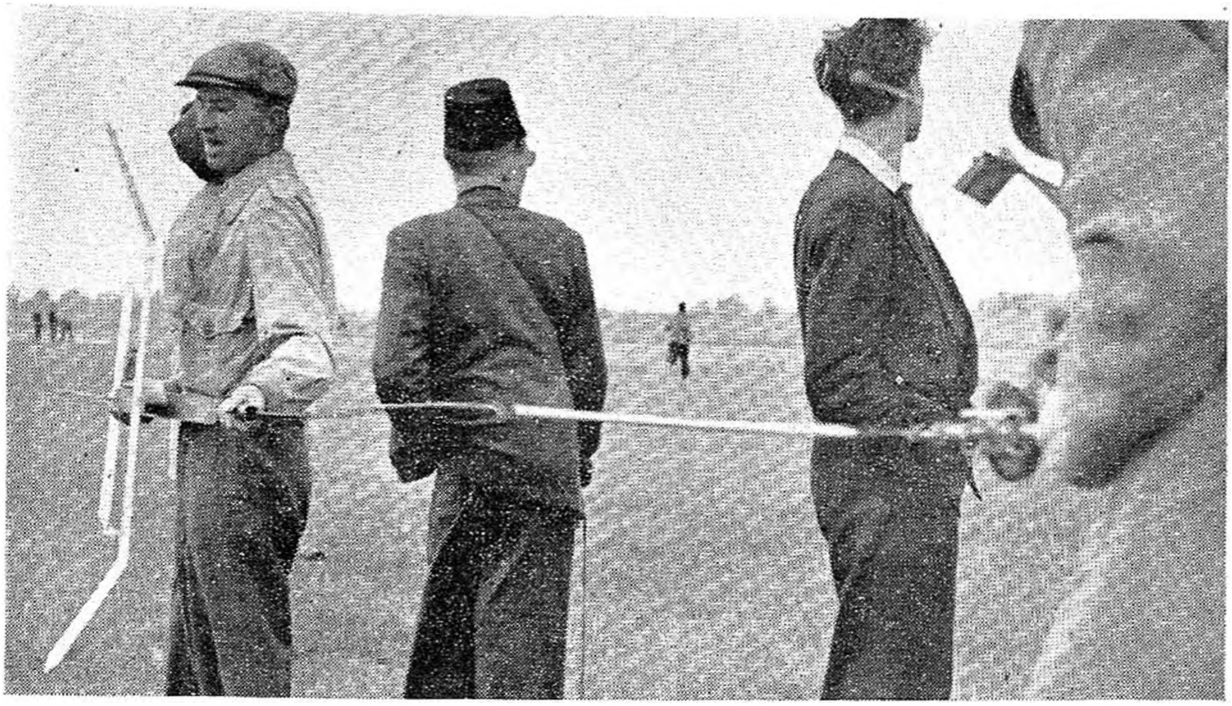
SPECIAL HIGH SPEED AIRCRAFT

HAWKER HUNTER WB 188—flown by Neville Duke. Scarlet doped all over with Day Fighter insignia and white serials.
SUPERMARINE SWIFT, W 198, Azure Blue all over, with Fighter insignia and black serials.



An inch to the foot scale control-line model of the Fairey Firefly Mark I by Captain C. Milani Power is provided by Fox 59 spark ignition engine, wings fold and opening cockpit displays more than 85 different instruments on the panel. This should prove that true scale models can be made that really fly!


EPERON G-5
DELTA GLIDER
By
JACQUES GERAUD
FRANCE
HARDWOOD BLOCK
1/8" SQ BALSA.
1/8" SHEET TRIM TAB
BALSA BLOCK
1/8" SHEET.
3/8" x 3/32"
31 1/2"
3/8" x 1/8" HARD BALSA.
1/4" x 1/8" BALSA L.E.
1/16" x 1 9/16" HARD BALSA T.E.
3/32" SQ. BALSA.
3/32" SHEET RIBS.
1/8" SQ. BALSA.
3/8" x 3/32" HARD BALSA
1/8" SHEET RIBS, FACED WITH 1/16" PLY.
3/8" x 3/32" BALSA
1/8" SQ BALSA.
1/16" SHEET.
SECTION A.A. FULL SIZE. ALL FORMERS 1/8" HARD SHEET.
ALL STRINGERS 1/8" SQ.
1/16" SHEET
SCALE 1/8 UNLESS OTHERWISE STATED.
1 3/16"
SECTION B.B 3/8 FULL SIZE.



The serious business of winding a rubber motor as exemplified by the Croydon club: note their tube winding system. Fez in background is purely coincidental and not essential!

BASIC CALCULATIONS FOR RUBBER MOTORS

RUBBER strip has the unfortunate tendency to exhibit varying mechanical properties, due to differences in formulation or processing. In general, however, grey rubber strip currently shows superior properties to brown rubbers; and the performance of best quality strip from different manufacturers, but of the same type (*e.g.*, grey strip), shows similar performances. Good strip is consistent throughout the length of the skein, has high resistance to fatigue, good torque characteristics and a high rubber modulus. Basic calculations applied to rubber strip of this nature yield reliable results and can be used to compute the performance of different sizes and weights of rubber motors. In all cases, however, working formulas include a coefficient determined, or determinable, by practical tests. These coefficients, once established, hold good for all calculations involving strip of the same quality and consistency.

Motor weight/length/section

The density of average grey rubber strip may vary between about .555 and .605 ounces per cubic inch. It is recommended that in all calculations involving density as a criterion the actual density of the sample should be measured by weighing a known length and calculating weight/volume. The *nominal* size of the strip is not necessarily an accurate measure, particularly as regards the width dimension. For example, actual samples of $\frac{1}{4}$-strip (nominal size) have shown true measured dimensions ranging from .220 to .248 inches, according to manufacture. Regardless of the actual dimension, most modern strip rubbers show excellent dimensional consistency throughout the length of a skein.

Motor length for given weight

Made-up motor length (L) (given weight) $= \dfrac{W}{B \times T \times \Delta}$ 1

Weight of motor (W) (given length) $= B \times T \times L \times \Delta$ . . . 2

Approximate relationship:— $L = \frac{640W}{K}$ 3

where B = width of strip (in.) L = motor length (inches).
T = thickness of strip (in.) Δ = rubber density (ounces/cu. in.).
W = weight of motor (ounces)
K = 4 for $\frac{1}{4}$ strip; 3 for $\frac{3}{16}$ strip; 2 for $\frac{1}{8}$ strip.

Equivalent section motors

X strands strip $A = \left(\frac{B_A T_A}{B_B T_B}\right) \times$ X strands strip B 4

where B_A = width strip A B_B = width strip B.
T_A = thickness strip A T_B = thickness strip B.

Approximate relationship

$\frac{1}{4}$ motor M strands — in $\frac{3}{16}$ strip $\frac{4M}{3}$ strands — in $\frac{1}{8}$ strip 2M strands 5

$\frac{3}{16}$ motor N strands — in $\frac{1}{4}$ strip $\frac{3}{4}$N strands — in $\frac{1}{8}$ strip $\frac{3}{2}$ N strands 6

Added weight of lubricant

Usually this is quite small and accounts for approximately 5 per cent. or one-twentieth of the made-up motor weight for adequately lubricated rubber. *E.g.*, to estimate the weight of a made-up, lubricated motor, add 1/20th to calculated or determined dry weight.

Pre-winding or breaking-in

The mechanical characteristics of new rubber strip are not consistent until broken in. During this process a permanent set is produced equivalent to an increase in made-up length of 10 per cent. A higher *temporary set* may be produced, measured immediately after the break-in (up to 20 per cent. overall increase in made-up length). On being allowed to rest (minimum period advised, 12 hours) this is fully recovered to the normal permanent set limit. Excessive "set" or elongation beyond the made-up length is an indication of fatigued rubber.

Maximum turns

Maximum turns are inversely proportional to the square root of the cross-section of the motor, and directly proportional to the length of the motor. Motor lengths normally referred to for purpose of calculation are made-up lengths, not length after taking up the permanent set. For comparative purposes, it is usual to compute maximum turns per inch motor length, determining the coefficient "K" by practical tests (approximately 8.0 for average strip). It should be noted that once "K" is determined for a particular sample made up into *any* number of strands, maximum turns per inch for motors made from the same rubber but different number of strands can be calculated.

$$\text{Maximum turns} = \frac{K}{\sqrt{\text{motor cross section}}} \quad ..... 7$$

For any particular size of rubber strip

$$\text{Maximum turns} = \frac{K_1}{\sqrt{\text{number of strands}}} \quad ..... 8$$

K_1 being determined by test on a suitable motor.

Formula (8) can be re-written.

$$\text{Maximum turns M strands} = \frac{\text{Max. turns N strands}\sqrt{N}}{\sqrt{M}} \quad ..... 9$$

Torque

The power output or torque from a rubber motor is proportional to (motor cross-section) $\frac{3}{2}$, hence

$$\text{Torque N strand motor} = \left(\frac{N}{M}\right)^{3/2} \times \text{torque M strand motor} \qquad \ldots\ldots 10$$

Formula (10) can be used in conjunction with formulas (7), (8), or (9) to investigate the possible effects of a change in motor cross-section, etc.

The torque output of a rubber motor is a varying quantity, being a maximum at first, dropping off fairly rapidly and then partially levelling out, but still decreasing in magnitude. "Average" torque may be considered as the actual torque generated at the mid-way point on the power run, *i.e.*, 50 per cent. of the useful motor duration. For normal motor sizes this is about one-half of the actual torque figure developed after 5 seconds' run. Initial torque (immediately on release) is even higher, but not readily measurable on the same scale. Hence for comparative purposes, torque at 5 seconds is taken as the "high" or initial torque figure. The greater the ratio initial torque: average torque, the greater the trimming difficulties likely to be experienced. A high average torque is desirable as prolonging the climb, but this must be considered in conjunction with the duration of the useful power run.

Energy Utilisation

The area under the torque curve represents the amount of energy generated by the unwinding motor. A useful comparison between motors of different sizes can be made by superimposing a "utilisation" envelope over the torque curve and computing the difference or "waste power." With normal trimming technique the boundary of the "utilisation" curve is established by assuming initial torque to be twice the actual torque at 10 seconds duration and joining these points with a straight line. Torque curve area above this line is then waste power. At the other end of the torque curve the "utilisation" envelope is terminated at the duration where torque falls below the minimum required to sustain horizontal flight.

Rubber Modulus

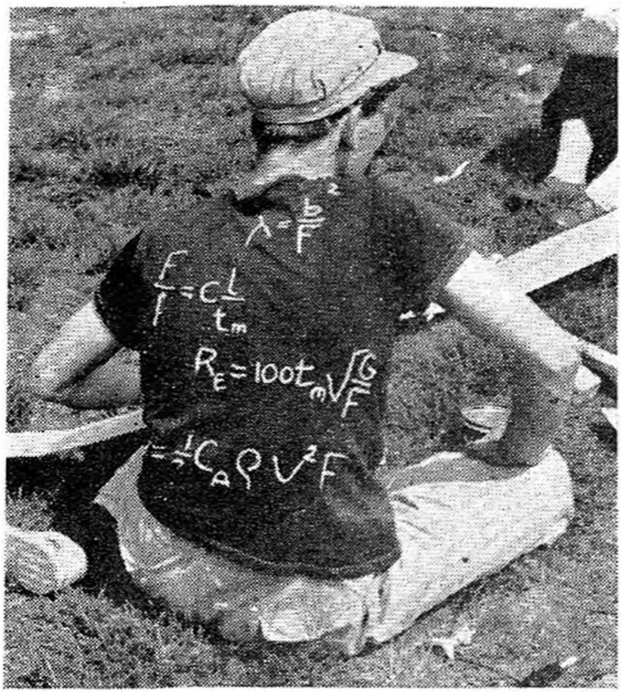
A much simpler method of assessing rubber quality than torque testing is to find the load-extension characteristics or "modulus" of a sample length of strip. If satisfactorily high, then the specimen is satisfactory. If the modulus values are low the strip is either of unsuitable quality, or fatigued.

Strictly, modulus figures should be calculated in terms of pounds weight (pull) per square inch (rubber cross-section) to produce a given stretch. A stretch to three times the initial length is an indication of "power" characteristics; a stretch to five times an indication of initial torque qualities. Satisfactory moduli figures are 1,300 and 3,500, respectively, for new rubber; and 1,200 and 3,000, respectively, for broken-in rubber.

For practical purposes, moduli figures can be related to standard strip sizes, viz:—

$\frac{1}{4}$ × 24 strip — new rubber — (X3) 24 ounces: (X5) 48 ounces.
broken in — (X3) 20 ounces: (X5) 36 ounces.
$\frac{3}{16}$ × 24 strip — new rubber — (X3) 16 ounces: (X5) 32 ounces.
broken in — (X3) 12 ounces: (X5) 24 ounces.

Lower moduli figures may be an indication of inferior strip, fatigued strip, or a strip of smaller actual cross-section than the nominal size specified.



There is no need for formulae to get your back up when, like this Dutch aeromodeller, you can carry them along to the flying field for handy reference. (*Photo: J. van Hattum.*)

WEIGHT DATA

In the trade balsa is graded according to density, ranging from soft stock of about 6 lb. per cubic foot up to hard or 16 lb. per cubic foot wood. Roughly, strength is proportional to weight, although since balsa is a heterogeneous material, considerable variations in both weight and strength may be experienced throughout any single specimen.

Selection of balsa for specific constructional jobs is a matter of judgment based on experience. To give meaning to the terms such as "medium," "medium-hard," etc., commonly expressed on plans, Table I lists a range of wood densities in terms of the weights of appropriate standard sheets. Corresponding strip weights can be calculated by simple proportion.

It should be understood that such a specification grades balsa by *weight* only. Once selected by weight, individual specimens must further be selected according to strength characteristics, and cut. In the construction of old-rule Wakefields, for example, where it was necessary to reduce structural weight to a minimum, nothing heavier than "light" balsa was acceptable for wing ribs. Not all 1/32-in. sheet weighing $\frac{1}{4}$ ounce or less could be used for ribs. A majority of sheet falling in this category was, in fact, unsuitable from the strength point of view. By careful selection, however, quarter-grain stock of as little as .2 ounce per sheet could be used, giving adequate strength and a resulting light wing structure.

Again as general rules: *soft* or *light* stock is generally used for sheet covered wing leading edges; *light* (quarter-

TABLE I. WEIGHTS OF BALSA SHEET

Sheet Size 36 x 3 x	Hard	Medium-Hard	Medium	Light-Medium	Light	Soft
1/4	4	3 1/2	3	2 1/2	2	1 1/2
3/16	3	2 5/8	2 1/4	1 7/8	1 1/2	1 1/8
1/8	2	1 3/4	1 1/2	1 1/4	1	3/4
3/32	1 1/2	5/16	1 1/8	15/16	3/4	9/16
1/16	1	7/8	3/4	5/8	1/2	3/8
1/32	1/2	7/16	3/8	5/16	1/4	3/16
1/64	1/4	7/32	3/16	5/16	1/8	3/32

Weight of Sheets in ounces

grain) stock for wing ribs, or *light-medium* where weight saving is not important; *medium-hard* stock for longerons and main stringers; *medium* stock for spacers; *medium-hard* or *hard* for wing mainspars; *medium* for wing leading and trailing edges.

Weights of covering materials are given in Table II. These represent average figures which may be expected, using normal covering technique and applied to white material. Colouring material may be expected to give slightly greater weights.

TABLE II. WEIGHTS OF COVERING

	Weight of Covering—ounces per 100 sq. in.				
	Covering Only	Plus 1 Coat Clear Dope	Plus 2 Coats Clear Dope	Plus 3 Coats Clear Dope	Plus 4 Coats Clear Dope
Jap Tissue	.028	.0315	.034	.0375	.041
White (Utility)	.0535	.0585	.0625	.0675	.072
Lightweight Modelspan	.0264	.0382	.053	.067	.082
Heavy-weight Modelspan	.055	.070	.089	.104	.125
Japanese * Silk	.05 — .15	—	—	—	—
Nylon *	.15 — .20	—	—	—	—

*Subject to considerable variation according to Grade used.

Apart from the different weights of different covering materials it will be seen that the increase in weight following doping is greater for certain kinds of tissues than others. Jap tissue is the least absorbent, giving the lowest increase in weight on doping.

For design analysis the total surface area of a model, *i.e.*, the total area to be covered, can be taken as five times the actual wing area. This holds reasonably true for orthodox free flight models of all types, where wings, fuselage and tail unit are all covered. Hence the anticipated increase in weight due to covering and doping can be estimated on this basis, as in Table III. This shows that the increase in weight on a small model may be prohibitive if the wrong kind of covering material is employed.

The breakdown into component areas is useful, since this allows the increase in weight with "mixed" covering schemes also to be estimated—*e.g.*, rubber model fuselage covered in "heavyweight" tissue, remainder in Jap or lightweight tissue. Use of these data will also enable a fairly accurate estimate to be made of the total finished weight of the model on completion of the airframe. If this is higher than required it allows the structure to be lightened to reduce weight *before* covering.

Component structural weights may be estimated on a percentage total weight basis. Typical data are given below, based on an analysis of a number of first-class designs. All weights referred to are for covered and finished components.

TABLE III. SAMPLE ANALYSIS COVERING WEIGHTS
200 sq. in. model. Total surface area = 5 x 200 = 1,000 sq. in.

	Covering Scheme		
	Jap Tissue	Lightweight Modelspan	Heavyweight Modelspan
Covering	.28 oz.	.264 oz.	.55 oz.
1 Coat Dope	.315 „	.382 „	.70 „
2 Coats Dope	.34 „	.53 „	.89 „
3 Coats Dope	.375 „	.67 „	1.04 „
4 Coats Dope	.41 „	.82 „	1.125„

Figures represent increase in weight.
Note: for further breakdown, surface areas of individual components may be estimated as follows:—
Wing surface area = 2 x wing area.
Fuselage surface area = 2 x wing area.
Tail + fin surface area = wing area.

RADIO CONTROL MODEL—16 oz. per. sq ft. wing loading.

Fuselage + undercarriage	33 per cent.
Wings	20 ,,
Tailplane	4 ,,
Engine, prop, fuel tank	10 ,,
Radio control gear (incl. batteries)	33 ,,
	100 ,,

OLD RULE WAKEFIELD—unlimited rubber.

Fuselage + fin	15 per cent.
Wings	12 ,,
Tailplane	2.5 ,,
Undercarriage	3.5 ,,
Prop. assembly	12 ,,
Rubber motor	55 ,,
	100 ,,

NEW RULE WAKEFIELD—80 grams rubber weight.

Fuselage + fin	20 per cent.
Wings	15 ,,
Tailplane	5 ,,
Undercarriage	5 ,,
Prop assembly	15 ,,
Rubber weight	33 ,,
Trim weight	7 ,,
	100 ,,

A2 GLIDER (FAI CONTEST).

	Short nose	*normal nose length*
Fuselage — fin	35 per cent.	38 per cent.
Tailplane	30 ,,	35 ,,
Wings	2.5 ,,	3.5 ,,
Ballast	32.5 ,,	23.5 ,,
	100 ,,	100 ,,

POWER DURATION (OPEN)

Fuselage — fin — undercart	30 per cent.
Tailplane	6.5 ,,
Wings	20 ,,
Engine, prop, timer, tank	43.5 ,,
	100 ,,

POWER DURATION (FAI)

Fuselage — fin — undercart	30 per cent.
Tailplane	8 ,,
Wings	22 ,,
Engine, prop, timer, tank	40 ,,
	100 ,,

"THE NORDIC ABROAD"

By J. VAN HATTUM

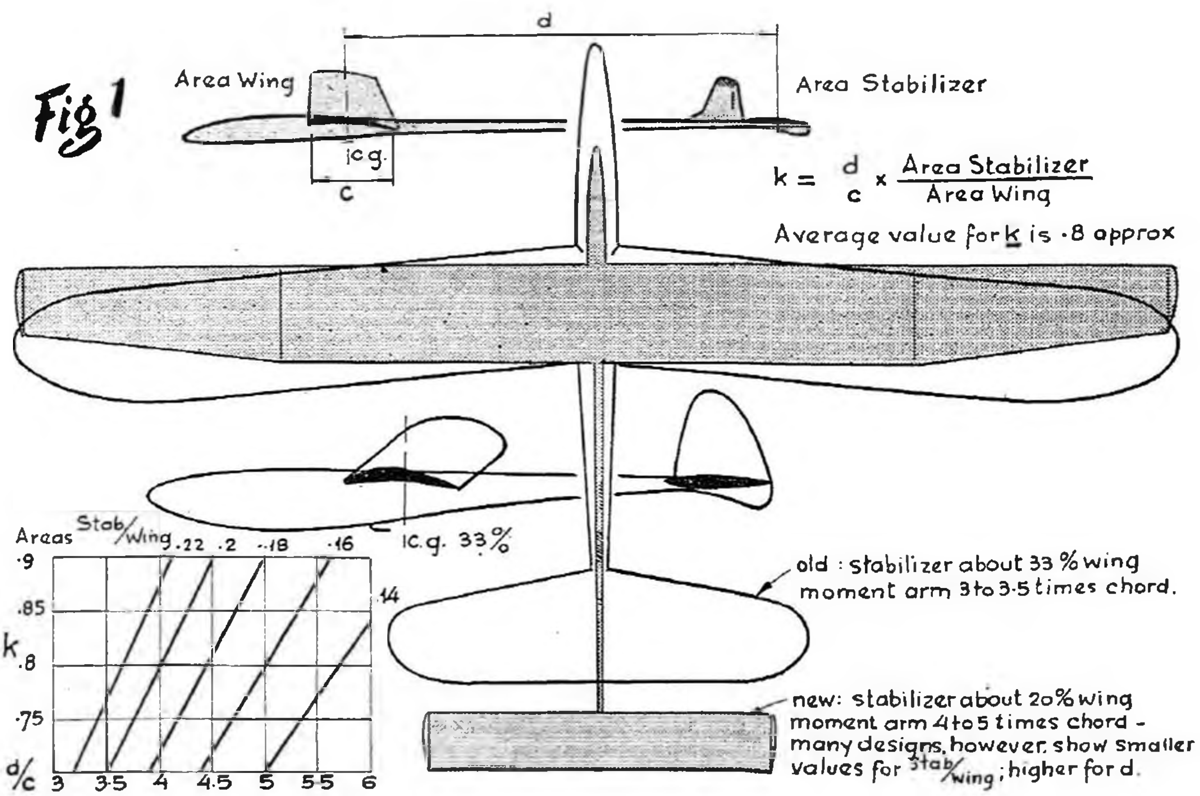
IF ONE could place our modern Nordics, slim and rather severe of line, next to the model sailplane we used to build only a few years ago, the change that only nine years or so have brought would be little less than surprising. The old designs, elephantine in appearance and stubby of proportions, have now passed like the Dodo. A new creature has arisen which not only differs radically in shape and girth, but also beats its predecessor in performance all along the line. Model sailplane design is now much more a matter of logical arguments and reasoned choice than it used to be; form and line and proportions can now be chosen with a much greater degree of assurance than in the days of old.

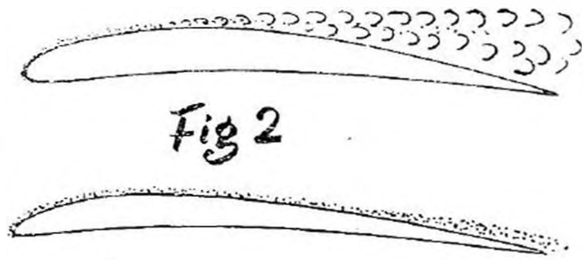
How has this radical change come about?

The true basis is due to a small group which has been blazing a trail which is now being followed by a great army. F. W. Schmitz in Germany, who has done more for scientific design than any other, has laid the foundations in his book "Aerodynamik des Flugmodells" (Aerodynamics of the Model Aeroplane). We still have only the first published part of his experiments and the second book is eagerly awaited, for this will contain test results of modern aerofoils.

Schmitz's book stressed the importance of the Reynolds' Number on the nature of the airflow around aerofoils of short chords and moving through the air at low speeds, as is the case with our models. His insistence that an aerofoil should be chosen which guarantees the most favourable type of flow, is the basis of modern design. For it is the wing which demands our greatest attention so far as aerodynamic design is concerned.

Fig 1





Top: Section with round nose. Laminar flow will not follow upper camber and break away results.

Lower: Section with sharp nose as described in text allows turbulent flow to be retained over most of the upper surface.

Left: Jacques Morisset with a typical "early period" French A/2, with conventional fuselage, strut braced shoulder wings, and twin half-fins.

Generally speaking, a turbulent boundary-layer is the main characteristic of the airflow we require in order to obtain maximum performance and Schmitz has clearly indicated the way in which this can be achieved.

His theory ended at one blow the useful life of our great and famous sections such as RAF 32, Eiffel 400, Gottingen 497 and others. In their place have come much thinner sections with their typical low and fairly sharp nose and nearly straight rear-portion of the upper surface. They look, in fact, much more like sections of birds' wings than the older types.

The sharp nose serves as a turbulence promoter. The airflow which meets the aerofoil at the lower surface a little behind the nose, is divided in two masses; one of which flows up and around the nose to follow the upper surface. The other mass of air flows along the lower surface and this presents no particular problems so far as the flow under normal circumstances is concerned.

The flow over the supper surface contains the secret of successful performance. The air travels from the dividing point, which is the point of greatest dynamic pressure, with very high acceleration around the nose to the upper surface. The flow is highly unstable when it is of the smooth-layer or laminar kind and will easily break away and form a cone of vortices over most of the upper surface.

The air streaming along the upper surface—that is across-chord—is moving into a region of relatively higher pressure as it nears the tail of the aerofoil. It will require energy to do so and at the same time contact with the surface of the wing will tend to slow down the very thin contact-layer which we call the boundary-layer. The airflow will require constant feeding with outside energy to be able to continue flowing in the direction of the chord, in order that it shall not slow down and break up into vortices. Now, in the laminar type of flow we cannot feed the air with new outside energy, which, to put it very simply, will not be attracted to mix into the airflow.

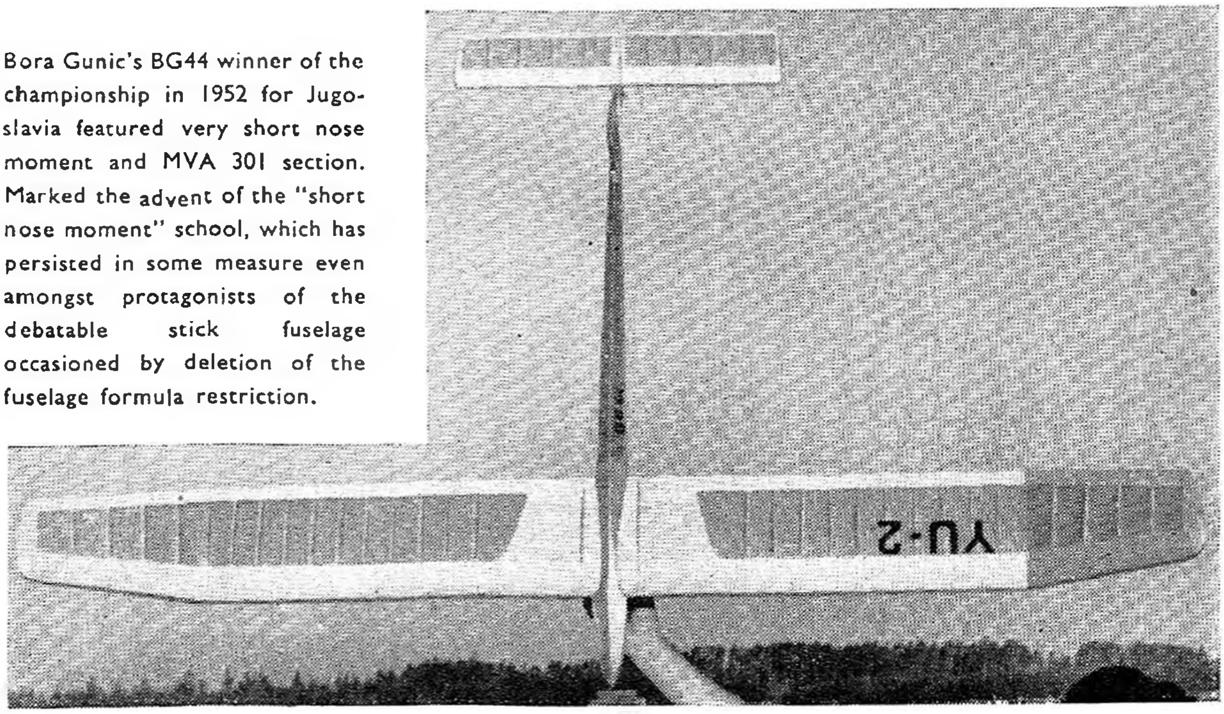
When the boundary-layer is of the turbulent type, however, fresh air can and will mix into the airflow which was in danger of being slowed up. Turbulent boundary-layer flow will, therefore, enable us to maintain a continuous flow over most of the upper surface.

It is often argued that turbulent flow will raise the friction drag and that is quite true. Laminar flow causes less friction drag but at the low Reynolds' numbers we use, the break-away will raise the induced drag to such an extent that the advantages are completely lost. This is just one of those cases where full-size methods do not apply to our models and this should be fully realised, for in scientific design one should use all the facts and knowledge related to the problem in question.

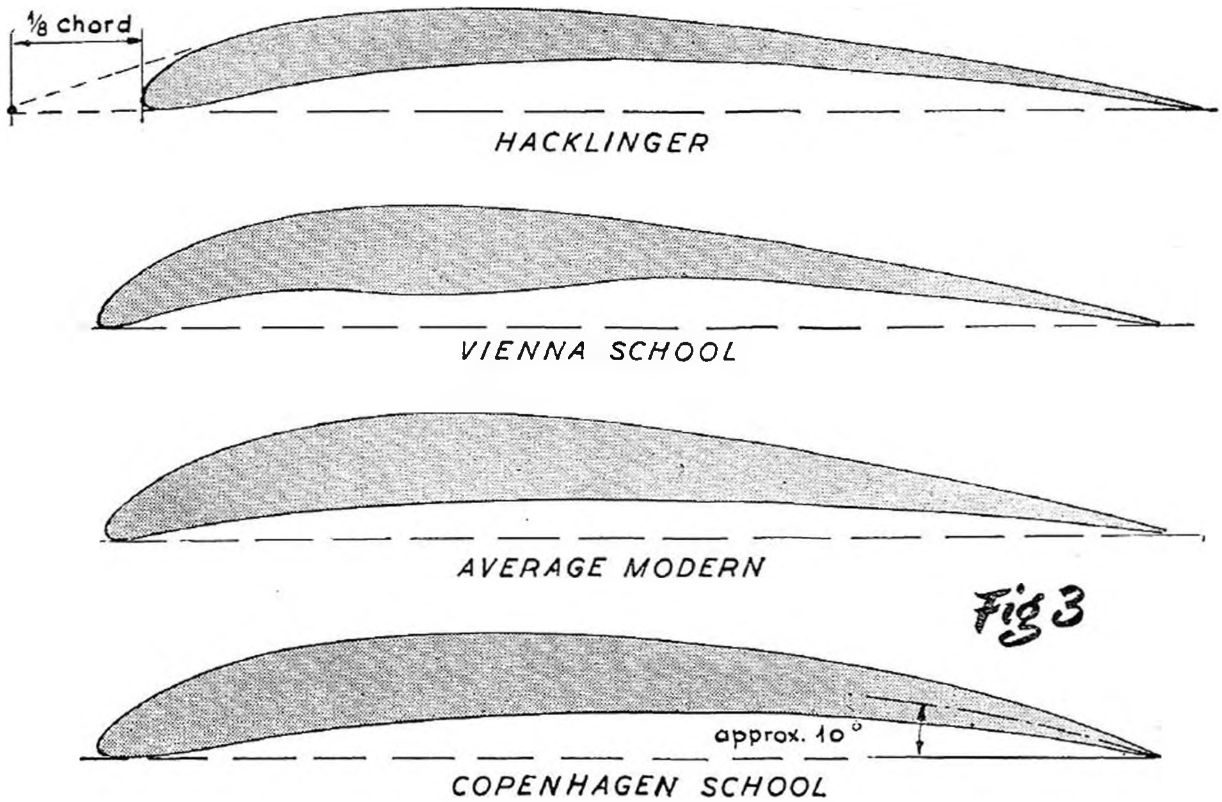
We do not quite succeed in realising the ideal and there will generally still be some degree of break-away at the tail-portion of the aerofoil. The flow may also be defective when the curvature or camber of this rear-portion is pronounced. It can be kept at a reasonably low level and modern aerofoils often are characterised by a nearly straight tail-portion which starts from about 60 to 70 per cent of the chord.

This is not the whole story, for other research workers have obtained good results by rather different means. The Hansen aerofoil, used by the winner of the 1953 Nordic Championships, shows a departure from the type sketched overleaf, and it is said that some very good results have been obtained with it, in Denmark as well as abroad.

This aerofoil is characterised by a fairly normal modern aerofoil shape as far as the first two-thirds are concerned, but the tail is bent fairly sharply downwards and can be compared with a faired flap, lowered to about 10 degrees. The centre of the aerofoil shows a "flattening" of the top surface. This aerofoil is no contradiction to the theory outlined above. Since in most cases the flow over the rear-portion of the chord is already in a stage of break-away, there is no objection and possibly much advantage in lowering the "flap" and in this way increasing the lift. It is now a matter of deciding whether the increase of lift has been obtained at the price of an undue rise in drag. This



Bora Gunic's BG44 winner of the championship in 1952 for Jugoslavia featured very short nose moment and MVA 301 section. Marked the advent of the "short nose moment" school, which has persisted in some measure even amongst protagonists of the debatable stick fuselage occasioned by deletion of the fuselage formula restriction.



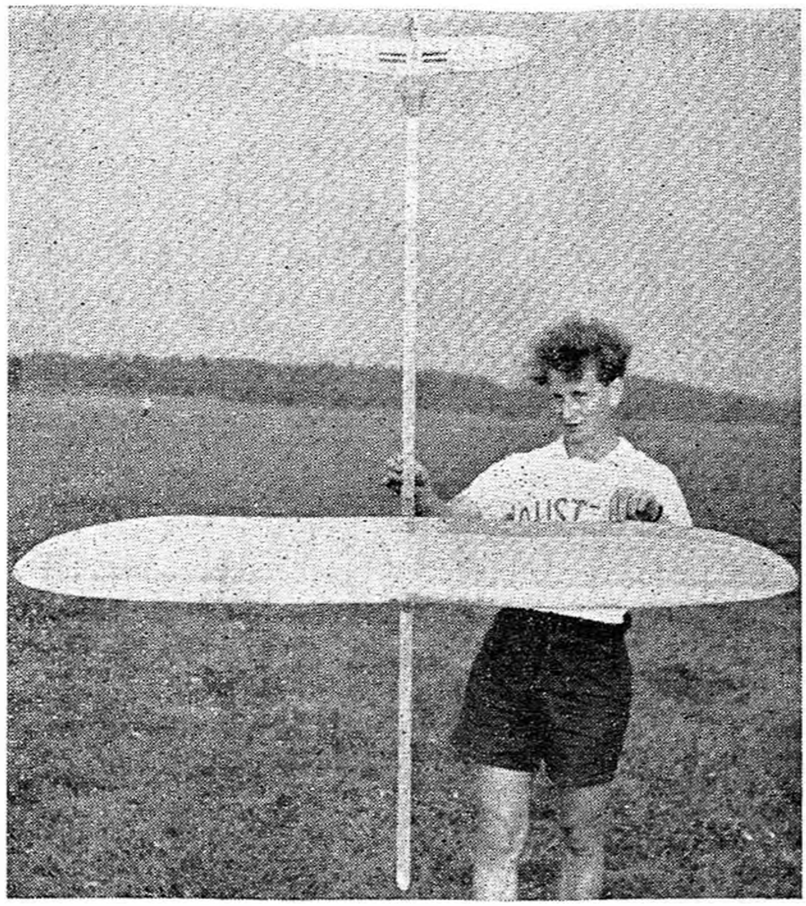
is not so much a matter of the L/D ratio as the ratio $c_L{}^3/c_D{}^2$; the ratio which determines the sinking speed, which governs the time the model will take to reach ground-level from a given altitude.

Practical results appear to have borne out the expectations of the designers, although more data will be needed to enable us to decide whether the Hansen aerofoil is indeed superior in every way to the aerofoils more commonly used. Isolated cases may be due to quite different causes, such as superior trimming and stability.

Another and quite distinct approach is the use of the turbulence-thread which is designed to promote a turbulent airflow created a little distance in front of the leading-edge of the aerofoil. In principle this falls into the Schmitz theory and his book gives detailed reports of tests with such turbulence threads.

According to Schmitz, the turbulence-thread may be used to raise an otherwise unsuitable, very thick, aerofoil into the

Unusually attractive design by L. Delhalle, Belgium, at 1954 contest, which in spite of no-fuselage-restriction era retains conventional body form and strut bracing.



Oskar Czepa's 1951 winner—the famous "Toothpick," a stick fuselage design with tailpod to make up cross-section. Wing section is Czepa's own, basically of the Viennese school, whence he hails. Note also butterfly tail and small fin. Nose moment is comparatively long.

acceptable turbulent boundary-layer class and so to good performance. Unfortunately, very little has been published of experiments with such sections of very small chord and fitted with a turbulence-thread, for here would appea rto lie the solution of the structurally efficient wing for small models.

The results of practical application of the turbulence-thread appear to be good, since Hacklinger of Germany has obtained very good flights with his model thus equipped. It has been used by others who greatly favour this method. However, it is always difficult to assess the actual rise in improvement due to such devices. Only a considerable mass of comparative data, obtained under rigid controls, can provide the answer.

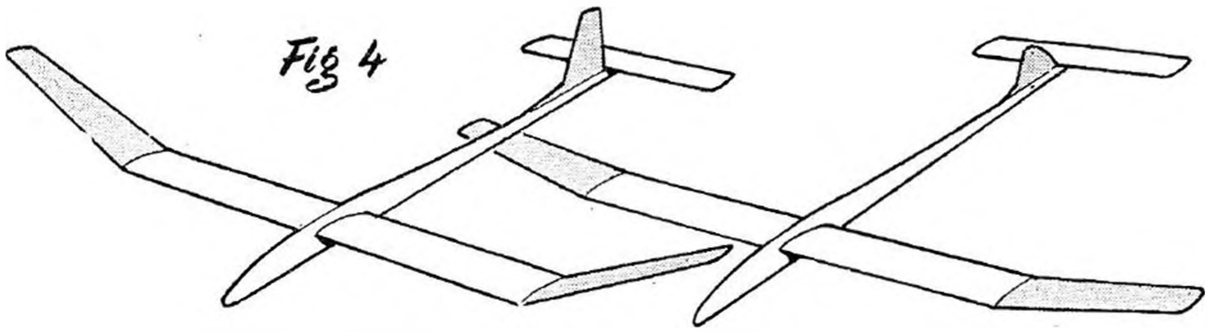
Only too often does unsubstantiated enthusiasm lead to glowing reports which are not supported by facts. That the turbulence-thread can achieve results is demonstrated by Hacklinger who dares to use a wing-chord of only 135 mm. (5.4 inches), a figure far below that acceptable for wings not provided with a special turbulence device.

Jedelsky and his Vienna group have carried out extensive and very carefully planned experiments on thin aerofoils, with the curious but logical "Flamingo" section as one result. This retains the "turbulent" upper surface, combined with a lower surface with inverted camel's hump. Since the lower surface, which is a high-pressure region, can easily contain such modifications of the contour, this section may be expected to have a good efficiency, combined with sufficient height to house a light structure.

I have discussed the aerofoil of the modern Nordic at some length, because it is one of the most important factors which govern performance.

No model is worth flying when it lacks perfect stability and by this we mean that it should return with as few oscillations as possible after a disturbance has upset the normal flight pattern. Stability is probably the most powerful ally in victory; high performance which can only be achieved under exceptional conditions is of little value in our contest-conscious world.

Stability and reliability go hand in hand and all we have said above

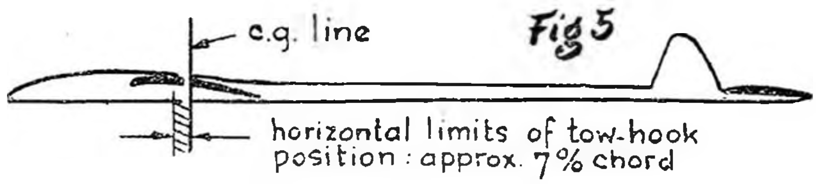


TWO LAYOUTS SHOWING THE RELATIONSHIP BETWEEN DIHEDRAL AND FIN AREA.

should first be carefully checked for its influence on reliabiltiy. Lateral stability is generally obtained on Continental models through straight or broken dihedral, of which the latter is more popular. Nordics do not require large dihedral which leads to over-stability and in its turn will require a large fin in order to avoid "Dutch roll." So far as we know, lateral stability has not presented a designer with any particularly difficult problems.

Directional stability, however, has proved something of a bugbear, mainly on account of the fact that the proper distribution of side-area for tow-line launch and free flight may sometimes present rather difficult problems. It is very difficult to give any satisfactory recipe for such cases and every design should be judged on its merits. Generally speaking, directional stability in free flight can easily be arranged and it is the directional stability under tow that needs attention and, often enough, correction. It should here be pointed out that by directional stability, we do not mean the tendency of the model to fly in a straight line, but only that it will behave in a normal and stable manner when disturbed from its original flight-path. If it flies in circles

George Perryman, U.S.A., with his modern 1954 A/2. He has followed stick fuselage trend with butterfly tail, and carries a touch of Frank Zaic's famous Thermic series in the larger chord outer wingpanels.



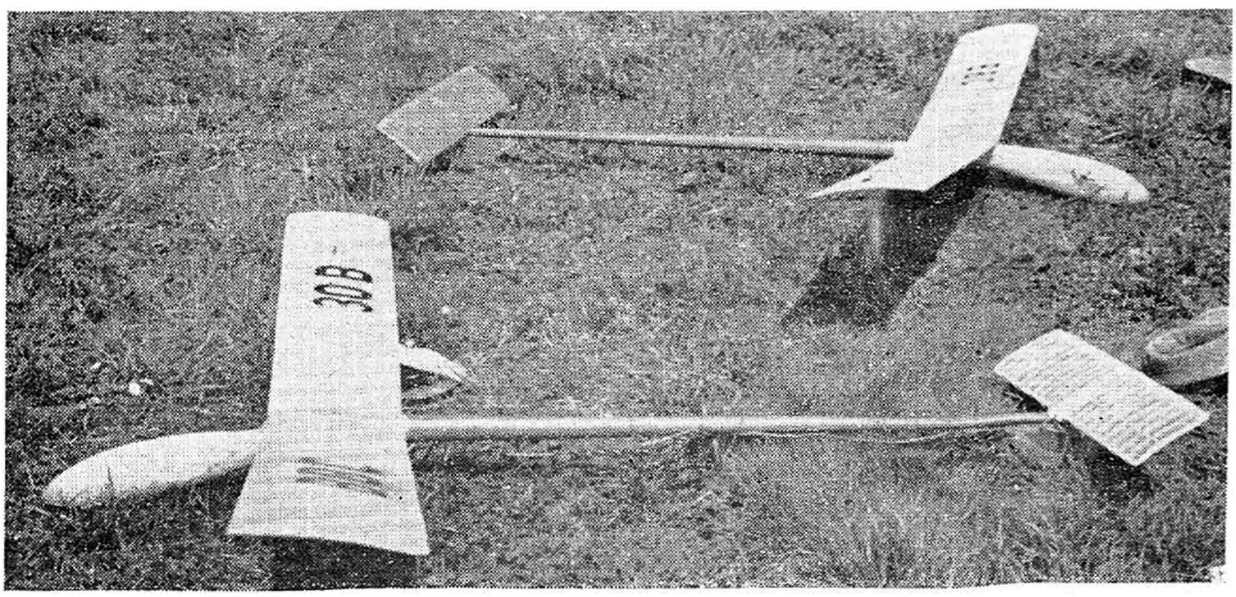
Rudi Lindner of Germany with his 1954 winner, typical of the latest modern trend. Wings are of very thin Hacklinger type section, fin is below tail, and forward fin shown in his original design has been omitted.

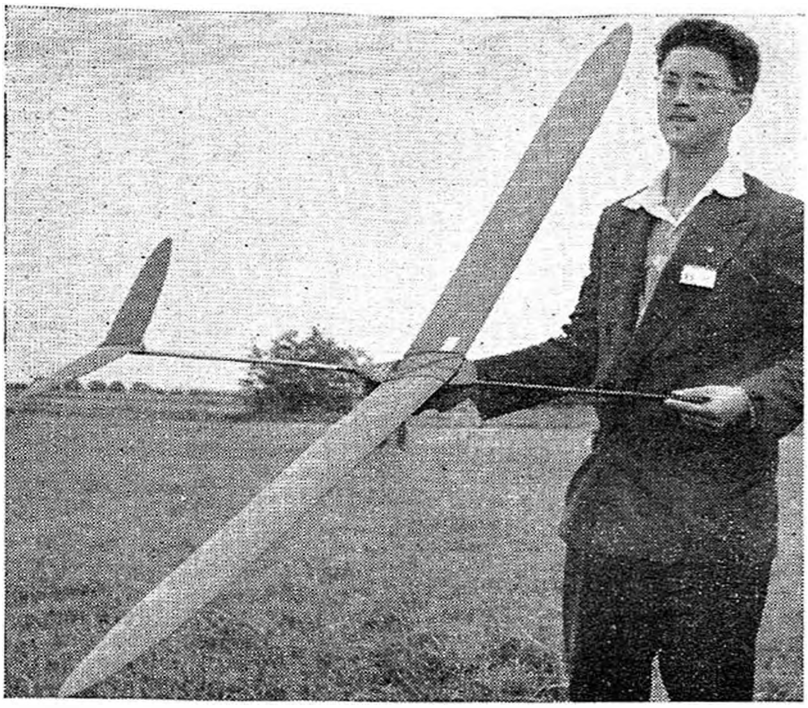
the flight should neither tend to develop into a tighter turn, nor should it become a spiral dive.

Most, if not all, Continental Nordics possess fins of minimum area, since this will enable the model to take advantage of thermals. When one uses an automatic rudder for a fixed rate of turn, a circling flight will always take place. Yet there is something to be said for a model which possesses what in Holland is called "sniffing" characteristics, as the model will go into a turn as soon as it meets a disturbance such as takes place when meeting a thermal. This needs carefully balanced design and there may be unexpected difficulties in the tow-line launch.

A very important detail, which can greatly influence tow-line stability, is the correct location of the tow-hook. This used to be placed fairly far forward, but until a few years ago it has been found that in many cases it is best situated nearly underneath and at the most a little way in front of the centre of gravity. This applies for all models which possess a so-called lifting tailplane

Typical models from Switzerland, a country which has devoted more time than most to glider development, though the national trend is towards bulkier fuselages suitable for slope soaring. Here the latest stick fuselage, with rudimentary pod, is embraced wholeheartedly. (*Photo: Dufey.*)





J. Lock of France with his 1954 model. Butterfly tail appears, and stick fuselage, a small pod being employed solely for secure main plane anchorage.

i.e., a tailplane which in normal flight carries an upload, as is the case with most models.

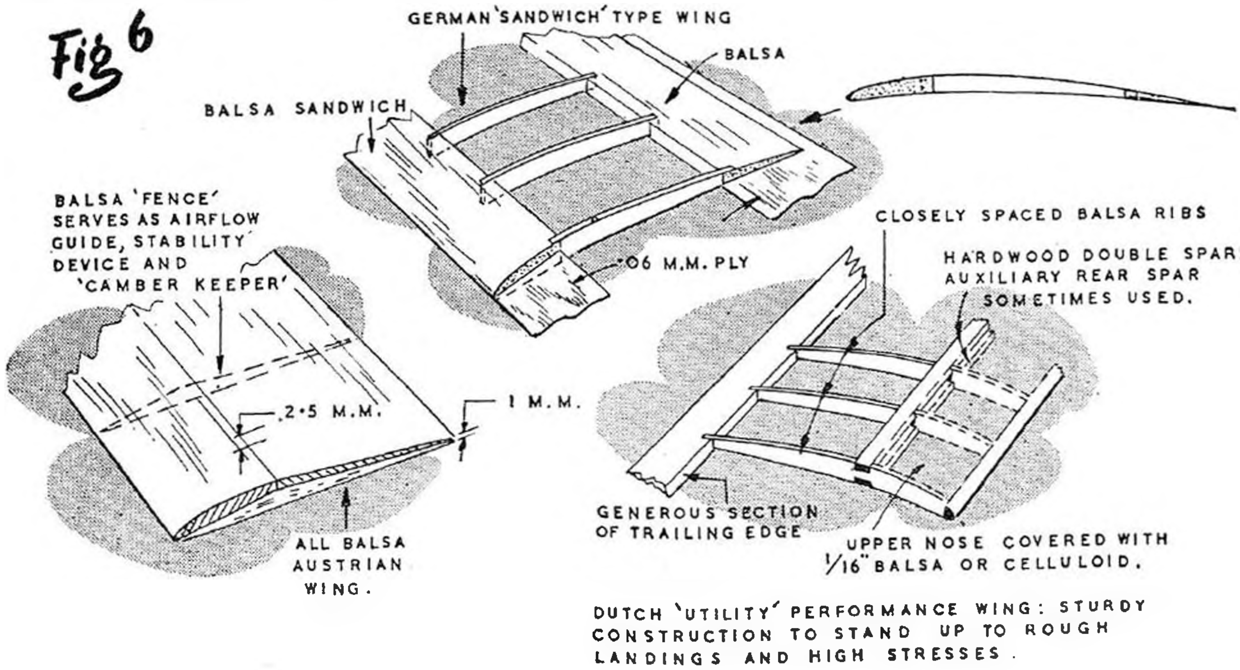
Contrary to widely accepted belief, there is virtually only one ideal location of the tow-hook relative to the c.g. for every model. First tests must show exactly where the hook should be placed, and it is customary to have either an adjustable hook or a battery of hooks around the expected correct position. Once the hook has been properly located, it should then be locked or the superfluous hooks removed.

Coming to longitudinal stability it is found in practice that there is only one c.g. position giving the desired flight characteristics under all conditions. Generally this is at 50 to 60 per cent. of the mean wing chord, depending on the layout of the design; c.g. position is rigidly bound up with the setting of the wing and tail which generally show a difference in rigging angles of 2 to 3 degrees.

When severely disturbed, the model will be stalled, but the stall should always be damped out after a minimum of oscillations.

One should never believe the advice that the c.g. should go forward when the model has to fly in a strong wind, for the best trim should never be spoilt in rough weather when it is most needed.

Fig 6



All this may show that first-rate Nordic design presents quite a few interesting problems which can well be compared with the design of powered models, which many regard as being on a higher level.

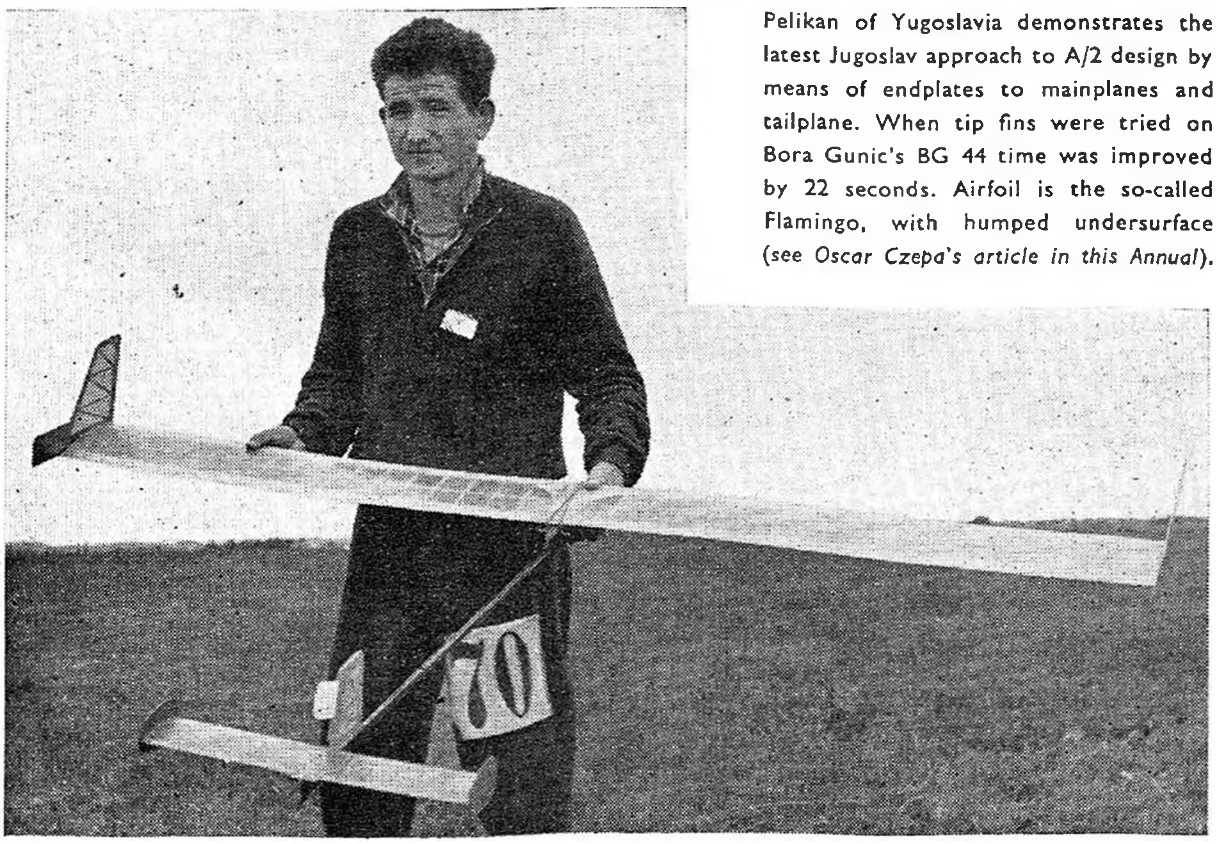
The more one studies this type of model, the more does one realise how much may yet be expected in design-improvement in the future. We are only at the very beginning of truly scientific design and the time will come when we shall be able, with a fair degree of accuracy, to predict sinking speed at various forward speeds and so choose the trim that will prove most effective.

Continental Nordic design differs structurally in some ways from British practice. In the first place some Continental designers use a relatively greater amount of hardwood, while British designers quite often employ balsa for all major components. The choice of material may noticeably influence external and structural design. Use of hardwood leads to smaller cross-sections of components, and, since sufficient rigidity must be obtained, the use of multi-stringer fuselages is often seen. We should have said, *was* often seen, for since the F.A.I. has abolished the compulsory minimum fuselage cross-section, no fuselage need have more bulk than the designer considers necessary for strength and rigidity.

Some Continental designs have gone right out for the broom or toothpick layout and the curious pods have now outlived their usefulness.

All-balsa fuselages, either of the planked or semi-solid type are also quite common, while one still sees the longeron-and-bulkhead type, be it that they only bear a rudimentary relationship to the sturdy elephant of the old days.

Fuselage design is very fluid these days and it is now almost impossible to classify design on a national pattern as used to be fairly easy a few years ago. In fact, Nordic design generally, has become internationalised to such an extent that it is very difficult to indicate national trends which show great



Pelikan of Yugoslavia demonstrates the latest Jugoslav approach to A/2 design by means of endplates to mainplanes and tailplane. When tip fins were tried on Bora Gunic's BG 44 time was improved by 22 seconds. Airfoil is the so-called Flamingo, with humped undersurface (see *Oscar Czepa's article in this Annual*).

extremes. This is mainly due to the increasedly effective distribution of technical news through the Press.

Austrian design is probably the most enterprising and many very clever new developments can be noted, such as extremely thin aerofoils and a minimum of wetted area. These models may be expected to be highly efficient, given the weather-conditions which suit them best, but it still remains to be seen how they behave in the kind of weather which the East coast of the Atlantic and Channel may have to offer.

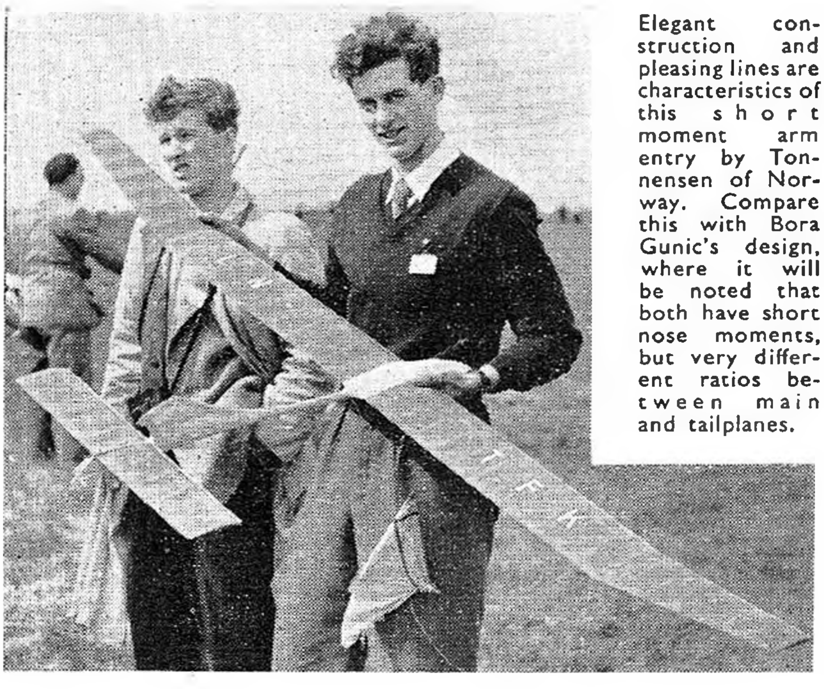
The same may be said of the Yugoslavian models which are also primarily designed for "light" conditions. German design tends towards a more sober-pod-and-boom layout but here, too, very thin aerofoils are in evidence and special constructions have been developed in order to obtain the necessary strength and rigidity.

French Nordics have not radically departed so far from the traditional sailplane layout, but the favourite strut-braced arrangement of the wings is now on the way out, through lack of fuselage height and consequent inefficient angle of the struts or bracing wires. It is somewhat curious to reflect that only the French designers have for so long employed wing-bracing in model sailplanes. The advantages of a simple wing-fuselage connection and, possibly, some saving of weight, does not seem to have influenced designers in other countries.

Scandinavian models have generally kept to a fairly close-coupled arrangement in contrast with the extremely large moment-arm of some German and Central-European designs.

Dutch models appear to follow a pattern closely similar to that of a few years ago, and radical designs have not shown up very successfully. The climate, and prevailing fairly high winds, force designers to aim at reliability and particularly excellent stability under extreme conditions.

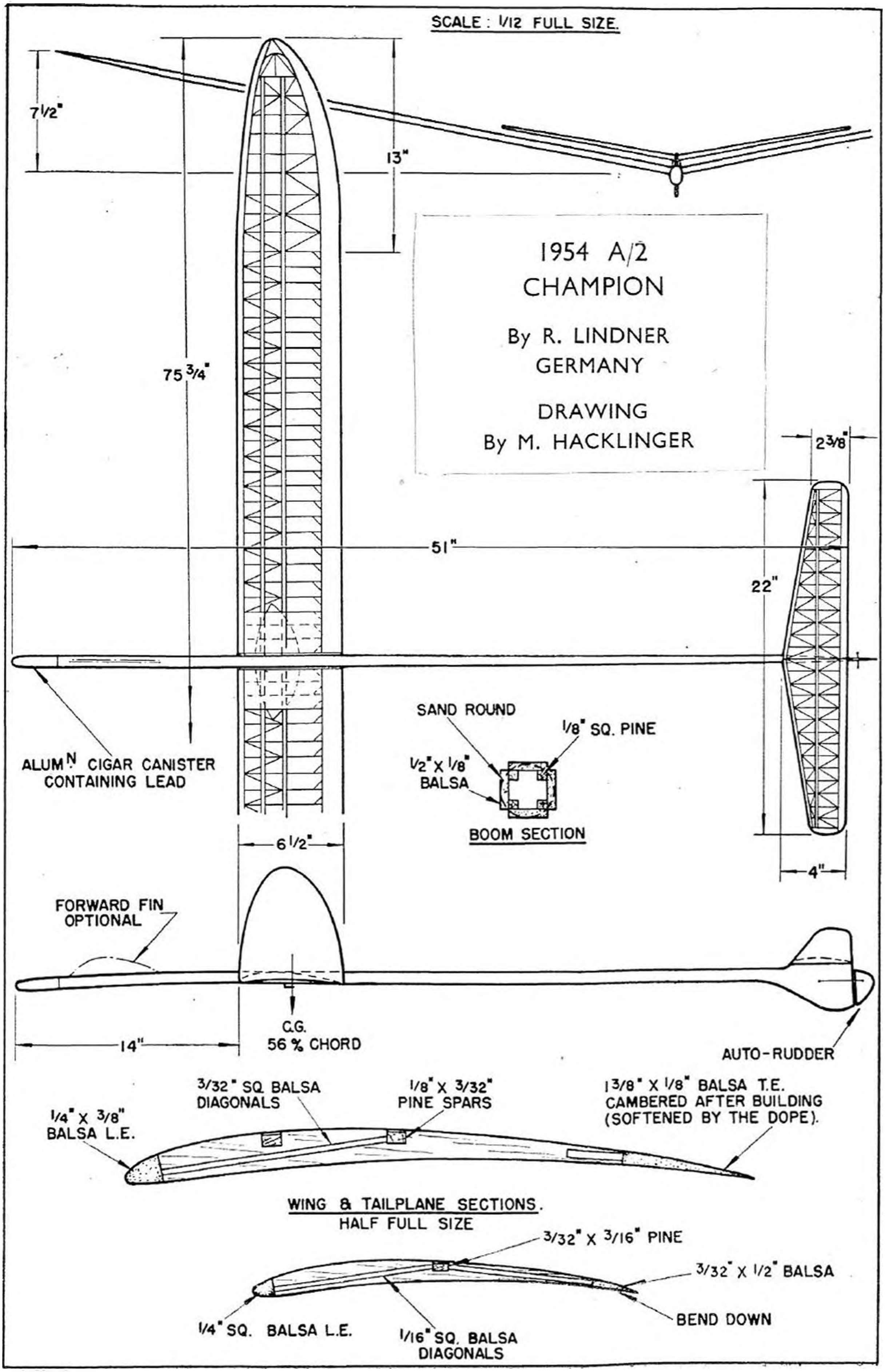
The same may be said of Danish designs, which, so far, have been fairly conventional. That this has not been at the expense of performance is proved by the 1953 winner, Hans Hansen, who clocked a threesome of six minutes against formidable opposition.



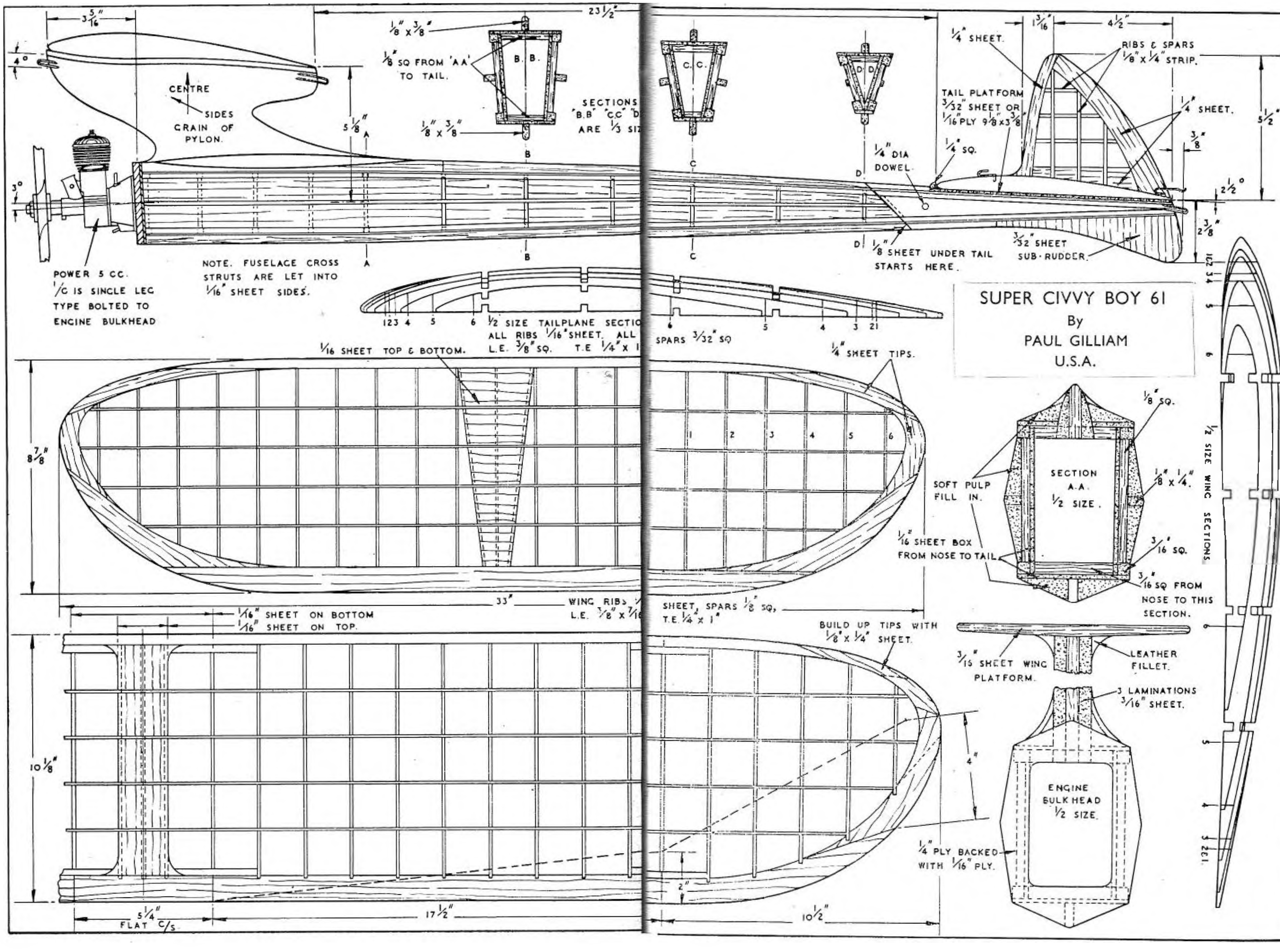
Elegant construction and pleasing lines are characteristics of this short moment arm entry by Tonnensen of Norway. Compare this with Bora Gunic's design, where it will be noted that both have short nose moments, but very different ratios between main and tailplanes.

Although, at the time of writing, we do not know what the 1954 contest may bring, it is worthwhile remembering that out of four Nordic Contests only once has it been won by a model which showed a radical departure from the generally accepted design-philosophy: Oscar Czepa's "Toothpick."

Even if this happens again this year, the more conventional design will still have three major wins to its credit.



SCALE : 1/12 FULL SIZE.
7 1/2"
13"
75 3/4"
1954 A/2
CHAMPION
By R. LINDNER
GERMANY
DRAWING
By M. HACKLINGER
2 3/8"
51"
22"
ALUMN. CIGAR CANISTER
CONTAINING LEAD
SAND ROUND
1/8" SQ. PINE
1/2" X 1/8"
BALSA
BOOM SECTION
6 1/2"
4"
FORWARD FIN
OPTIONAL
C.G.
56 % CHORD
14"
AUTO-RUDDER
3/32" SQ. BALSA
DIAGONALS
1/8" X 3/32"
PINE SPARS
1 3/8" X 1/8" BALSA T.E.
CAMBERED AFTER BUILDING
(SOFTENED BY THE DOPE).
1/4" X 3/8"
BALSA L.E.
WING & TAILPLANE SECTIONS.
HALF FULL SIZE
3/32" X 3/16" PINE
3/32" X 1/2" BALSA
BEND DOWN
1/4" SQ. BALSA L.E.
1/16" SQ. BALSA
DIAGONALS


SUPER CIVVY BOY 61
By
PAUL GILLIAM
U.S.A.
CENTRE
SIDES
GRAIN OF PYLON.
1/8" SQ FROM 'AA' TO TAIL.
SECTIONS 'B.B' 'C.C' 'D' ARE 1/3 SIZE
POWER 5 CC. I/C IS SINGLE LEG TYPE BOLTED TO ENGINE BULKHEAD
NOTE. FUSELAGE CROSS STRUTS ARE LET INTO 1/16" SHEET SIDES.
1/2 SIZE TAILPLANE SECTIONS
ALL RIBS 1/16" SHEET. ALL
L.E. 3/8" SQ. T.E 1/4" x 1
SPARS 3/32" SQ
1/16 SHEET TOP & BOTTOM.
1/4" SHEET TIPS.
1/4" SHEET.
RIBS & SPARS 1/8" x 1/4" STRIP.
TAIL PLATFORM 3/32" SHEET OR 1/16" PLY 9 1/8" x 3 3/8"
1/4" SHEET.
1/4" SQ.
1/4" DIA DOWEL.
1/8" SHEET UNDER TAIL STARTS HERE.
3/32" SHEET SUB-RUDDER.
1/8" SQ.
SOFT PULP FILL IN.
SECTION A.A. 1/2 SIZE.
1/8" x 1/4".
1/16" SHEET BOX FROM NOSE TO TAIL.
3/16" SQ.
3/16" SQ FROM NOSE TO THIS SECTION.
1/2 SIZE WING SECTIONS
WING RIBS 1/16" SHEET, SPARS 1/8" SQ,
L.E. 3/8" x 7/16" T.E. 1/4" x 1"
1/16" SHEET ON BOTTOM
1/16" SHEET ON TOP.
BUILD UP TIPS WITH 1/8" x 1/4" SHEET.
3/16" SHEET WING PLATFORM.
LEATHER FILLET.
3 LAMINATIONS 3/16" SHEET.
ENGINE BULKHEAD 1/2 SIZE.
1/4" PLY BACKED WITH 1/16" PLY.
23 1/2"
33"
17 1/2"
10 1/2"
5 1/4" FLAT C/S.
8 7/8"
10 1/8"
5 1/8"
5 1/2"
4 1/2"
3 5/16"
1 3/16"
2 3/8"
2 1/2°
3°
4°
4"
2"

ACTUATORS

By George Honnest-Redlich

ORIGINALLY IT WAS thought, and to a great extent still is today, that the radio transmission and reception would prove to be the major design difficulty for the reliable control of model aircraft. The conversion of the received signal into a mechanical movement to operate for example the rudder, was taken for granted, due perhaps to that outstanding development, the escapement.

Here in England, freed from any severe controls or licensing, we soon gained ascendancy after the war years. Our radio transmission/reception link improved to a point of reliability, evidenced in the lack of "fly aways" in recent years.

But with a few exceptions, we stolidly stuck to the sequence escapement, improved only in size, weight, and current saving devices.

It has come as a rude shock in the last twelve months that other countries have taken our supremacy away from us. Not due to any superior radio equipment or planes, but in applying the radio signals to the required controls.

I am taking it here for granted that the normal basic escapement and its operation is known, and shall endeavour to show and explain various other methods of mechanical control. The following diagram may help to illustrate and subdivide the ways and means of applying differing types of actuators.

I will not try to lay down any hard and fast rules as to what should be used for any particular purpose, but at the end of the article I shall give the

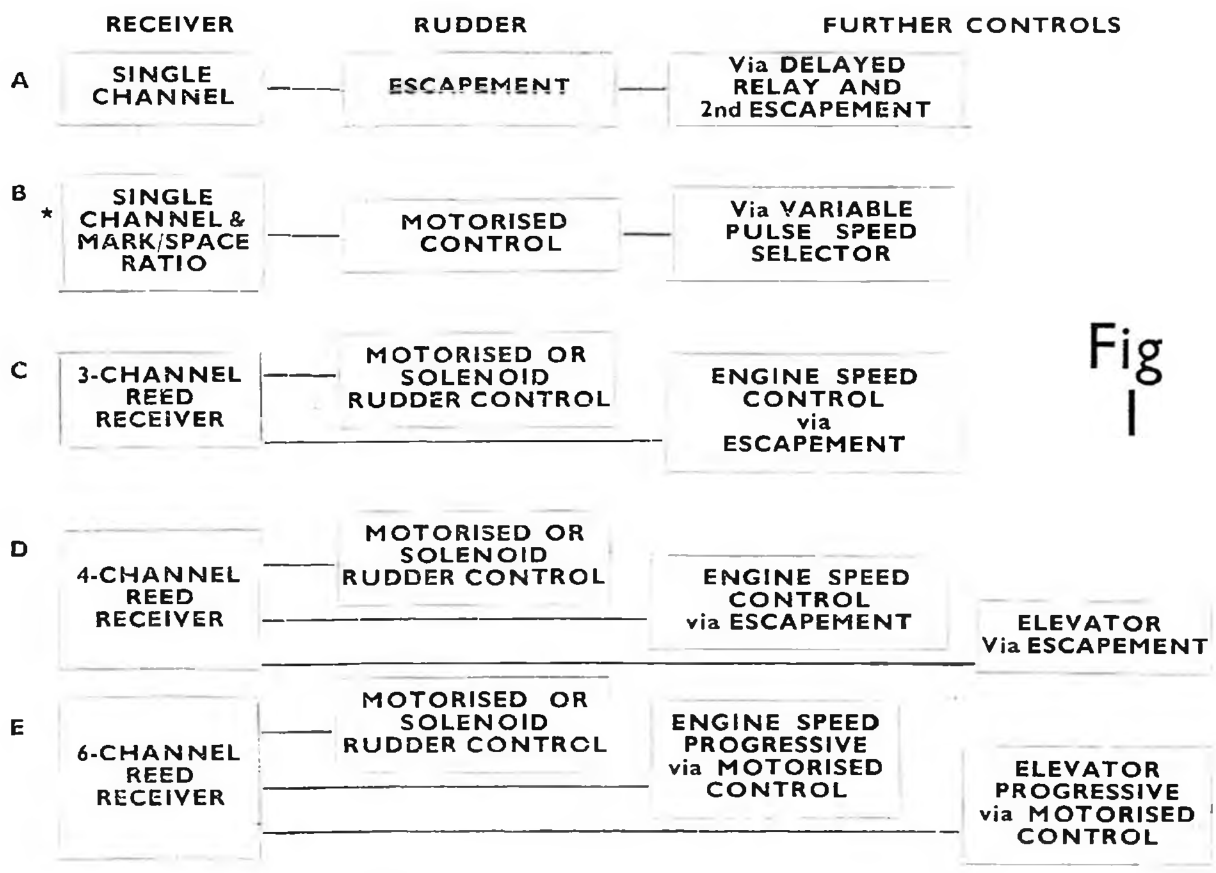
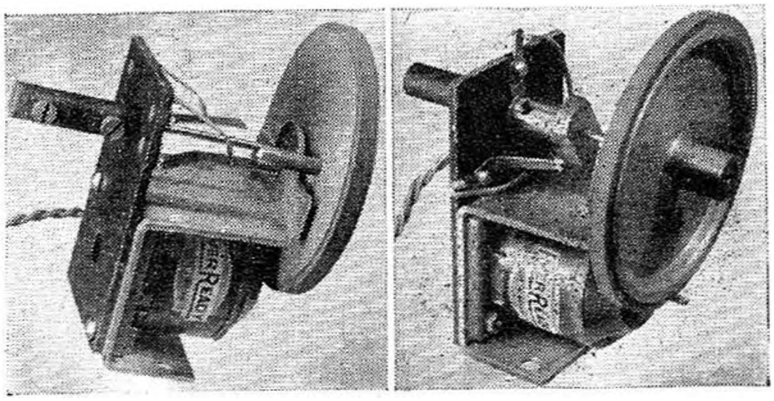


Fig I

* *Requires a pulsing attachment to transmitter.*



Motorised rudder controls using a friction driven reduction developed by G. Honnest-Redlich. Suitable for reed, or also for mark/space ratio system where pulse speed is high. Low current consumption (3 v. battery or 2 v. accummulator) and that only to move to position, no current flow when held in rudder turn.

layout of my particular choice in two differing planes. Far too much has been written upon various methods which on paper appear to be the solution. My advice is, get out on to the flying fields and to the competitions and see the equipment in actual use.

I must ask further to be forgiven for devoting a lot of time and space to the multi-channel actuator problem. I feel, however, that I am justified in this. Some five years ago, I felt that the single channel equipment had reached the end of its development as far as what it was capable of operating reliably. I have since devoted most of my spare time to open up and develop avenues of use for my multi-channel equipment. This development has been long and painstaking. I have been helped in this by my friend Ted Hemsley, whose plane has been pranged several times in the search for a foolproof rudder control only.

Now we come to the point of priority choice. Rudder of course is the first essential. Next, by far the most important, is engine speed control. Only third comes elevator, and fourthly the gadgets, although some of these, for example, parachute release, can be safely operated in conjunction with a not often used control, such as an escapement operated elevator.

Fig. 1 (A) shows the single channel receiver operating a normal self-centring escapement. If the escapement arm is arranged to make a contact on one of its neutral positions, this can operate a delayed relay, which in turn operates a second escapement. The relay delay should be in the region of one half to one second. Although reasonably well known, the delay circuit is given in Fig. 2.

It will be seen that the second escapement is only operated when the rudder escapement remains on the contact position for longer than the delay period. Therefore it is obvious that if the second escapement is not required to be operated, that particular neutral must be reasonably quickly by-passed. Its position can be easily remembered by the rudder movement. For example,

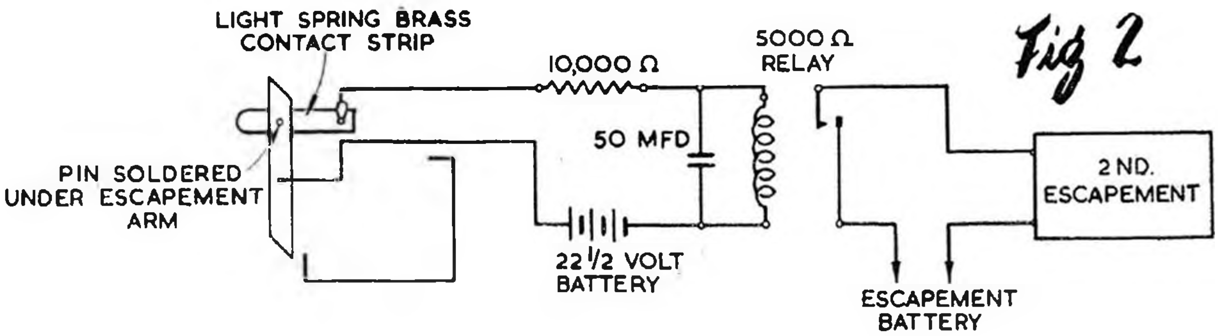
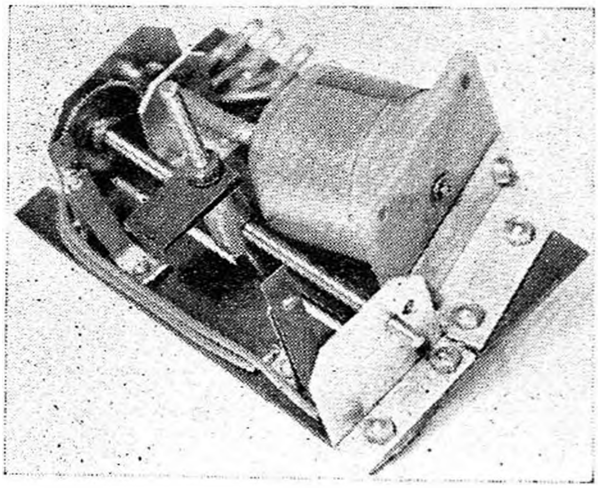
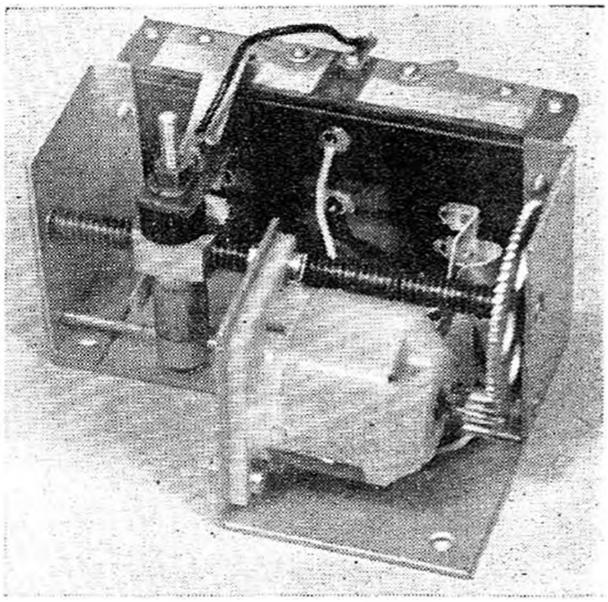


Fig 2





Leadscrew type of motorised control. This is a motor operated traveller, traversing from side to side. *Right:* Improved leadscrew type of motorised control with self-centring contact strip fitted.

it could be arranged so that the contact makes after a right rudder turn. Then the operation to by-pass it would be: after a right turn given another short pulse on the transmitter key.

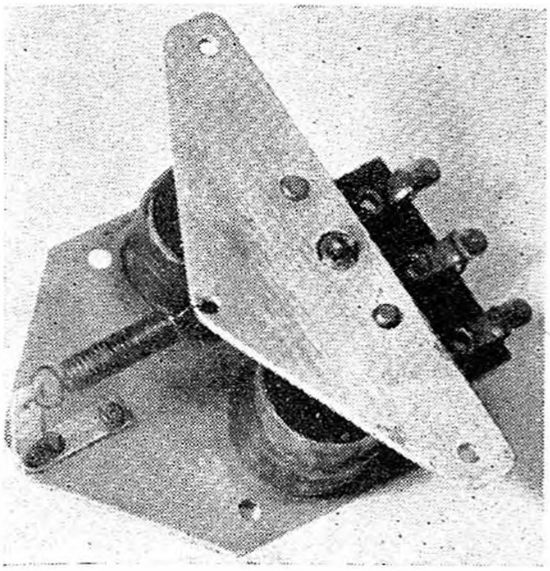
Fig. 1 (B) indicates the use of mark/space ratio systems. There are several commercially made actuators on the market. They all rely in the main upon an electric motor, which via a reduction gear, drives a control linkage, which on receipt of a signal is driven in one direction, and in absence of a signal is driven in the opposite direction. A variation of the ratio of the signal pulses, short signal/long interval or long/signal/short interval will cause the motor and the drive to the rudder to hunt in one or the other direction. An evenly spaced pulse will cause the motor to hunt evenly in either direction and the rudder will remain stationary. A variation of the pulse speed (more or less pulses per second) can, via the usual delayed relay, rectifier or inertia system, bring in a second control.

Fig. 1 (C), (D), (E) are versions of tuned reed multiple channel equipment, operated in this country to date. Here right away, I should like to say, do not attempt to operate more than one thing from one channel. If you really require a further necessary operation, use a further channel. The one exception is something which is only used once during a flight and is not necessary for the control of the plane, for example, parachute dropping.

Before going into details of the various types of actuators, let me mention one vital consideration. A model plane flies in a medium and under conditions in which a full-sized plane of today could never operate. We have to be able to fly in winds and gusts of winds, which in scale referred to the full-sized job, would be catastrophic in intensity and changeability. Therefore, even with the model's increased trim stability, the rudder control must be capable of being whipped from one extreme to the other to maintain direction. This necessity is aggravated by the fact that not being in the plane ourselves, there is quite a time lag between a wind-gust-caused turn or bank and our corrective control.

The electric motorised actuator usually consists of a motor-driven geared down leadscrew upon which the control carrying traveller can be traversed from one side to the other. Limit switches at either end prevent over-run if the operative signal is held on. This requires two channels of the

Solenoid operated rudder mechanism .This magnetic actuator has been tested extensively on the author's planes and proved highly successful.

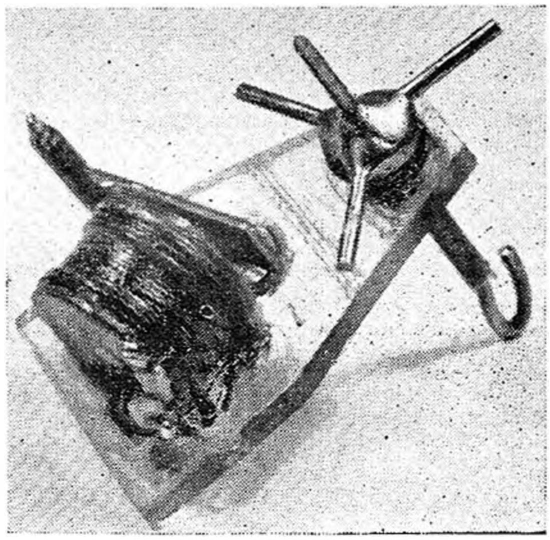


receiver. One for right movement, one for left. The rudder central position is not accurately determinable. Only by knowledge of its speed can one find the central position. For example, on one of my models, three short pulses returns the rudder from either of the limits to an approximate centre. A stable plane in reasonable weather can use this method with complete safety. By the addition of extra contacts this actuator can be made self-centring. But the circuit is quite complicated and as well as requiring double actuator batteries, it contains no less than twelve contacts including those of the relay. My personal experience is that most R.C. trouble is caused by intermittent or sticking contacts. I therefore avoid it like the plague.

My problem to find a selective self-centring rudder movement without further batteries and contacts, was solved by turning to magnetic actuators. Now, to attract an armature towards an electric magnet is not very easy if we require a large angular movement with a low battery consumption. Magnetic power decreases with the square of the distance. This is: an armature attracted from $\frac{1}{8}$ in. of the pole face is *four* times stronger than from $\frac{1}{4}$ in. away. Or for the same attraction power we would require *four* times the current. I have arranged my rudder mechanism armature to swivel *over* the pole face of the electromagnet. The air gap is never more than $\frac{1}{32}$ in. and the angular movement from centre is 30° each way. All this on 200 Ma at $4\frac{1}{2}$ volts. The armature is returned to centre by a light return spring which only has to overcome the rudder weight. The slipstream tends to aid the rudder return. If a balanced rudder is used, then the coils could be wound for an even lower consumption. The weight is only $1\frac{1}{2}$ oz.

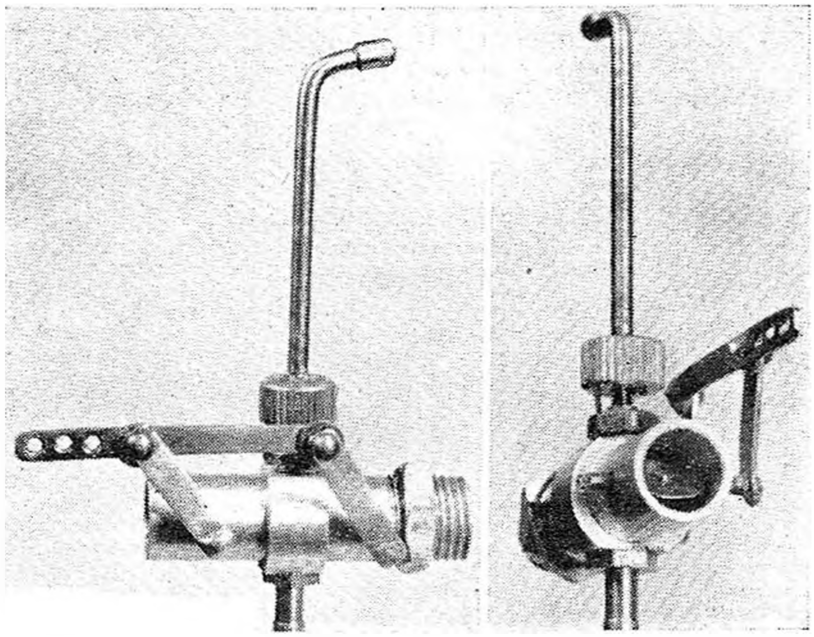
For engine speed control there are two methods according to the type of engine. With diesels I prefer to use one channel, using a simple rubber driven escapement operating my double butterfly throttle control. This gives only two speeds, flat out and a tick over. For competition work calling for stunts, a quick engine response is essential.

For ignition engines, a motorised control using two channels is probably the answer. Here the usual lead screw movement can, via a rod or light Bowden



A simple lightweight escapement, shown slightly larger than full size, made up by amateur r/c enthusiast and used successfully.

G. Honnest-Redlich's ingenious double butterfly engine speed control and jet assembly. Method of operation is via an ordinary clockwork type of escapement, which opens or closes the butterfly valves, thus giving two-speed engine control for diesels, a necessary refinement if controlled take-off and landing is to be practised.



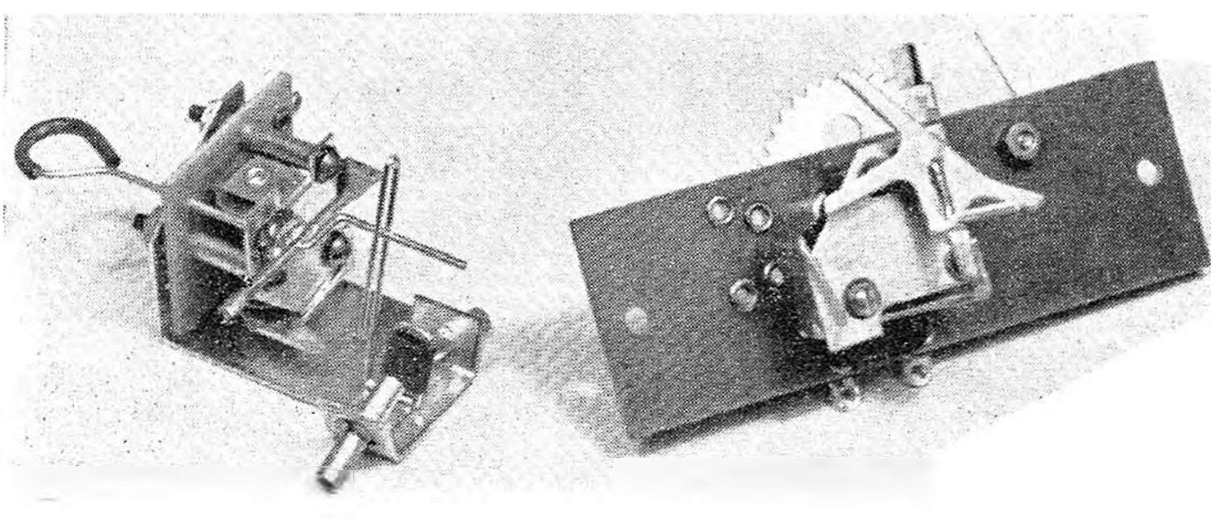
Below: Right, American Bonner compound escapement of 3-pawl type, with delay mechanism which permits operation of an additional 2-speed control, shown left. *Left:* Bonner 2-speed escapement, operated on the air-bleed principle by means of the rubber flap valve, seen below the crank loop.

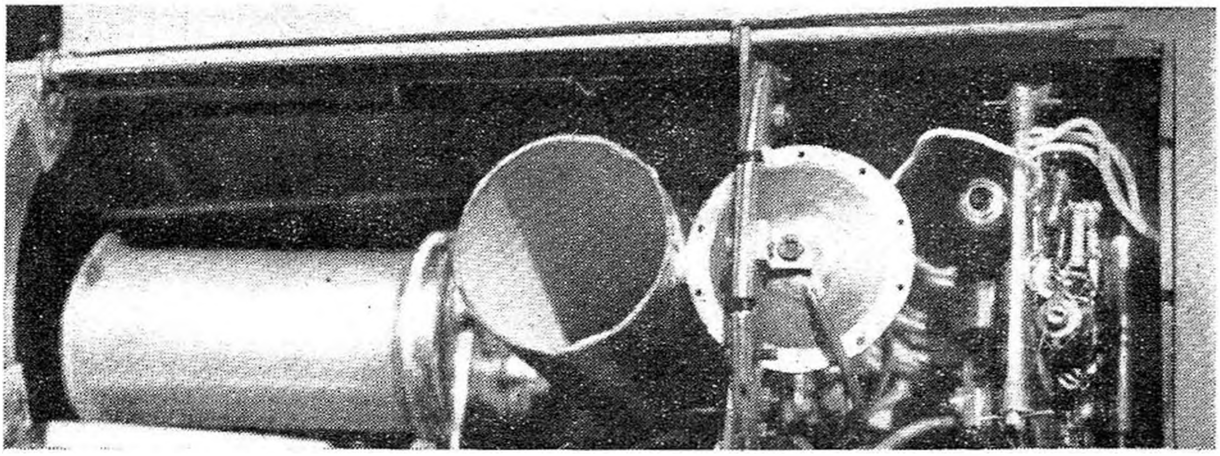
cable, operate the timing lever direct. Do not forget however, that at low speeds the jet suction is less and a semi-choke should come into operation over the intake at the low-speed end of the control movement.

Elevators require far more power to operate them than the rudder. If only used as a trim elevator, they can be operated by a normal elastic escapement. If however, they are required for stunts, then only a clockwork driven escapement will have enough power. Laterally model planes are most stable and quite a lot of area and power is usually required to overcome this inherent stability. Using two channels, the normal motorised mechanism with or without centring can be used.

Now let us look at some types of multi-channel planes in use. Firstly, Sid Allen and I have Radio Queens equipped with four-channel reed receivers. Two channels are used for a self-centring solenoid operated rudder; one channel for an elastic escapement operated two-speed engine control; one channel for a self-centring clockwork escapement operated elevator. These two planes have been consistent competition winners.

Now to the six-channel planes, which I really prefer for good flying. Ted Hemsley's perfect example uses two channels for a self-centring solenoid rudder control; two channels for an ignition engine progressively controlled





by an electric motor mechanism; two channels for a time tab type elevator progressively operated by the normal motorised control. For sheer flying, this is the job. Controlled take-off: from tick over to full engine power and slight up elevator after the tail comes up. After a steep climb, flatten out with neutral elevator and reduced engine power. Wind penetration: full engine power and slight down elevator. Real three-point landings; engine tick over and begin to ease the elevator up as she comes down, full up elevator just before touch down. That is flying; it is a pity that competitions call for the other type of plane.

Finally, I should like to mention a real masterpiece of thought, detail and execution. Kurt Stegmaier's vacuum operated actuators. We hope to see this system in England shortly, a full description will have to wait until then. In brief, the power is not batteries, but a vacuum produced via a valve from the engine crankcase. Various vacuum actuators are brought into use by electro-magnetically operated valves. These actuators have a two-pound pull. Although there are many advantages of this method, it will not entirely replace electro-magnetic or electromotive actuators.

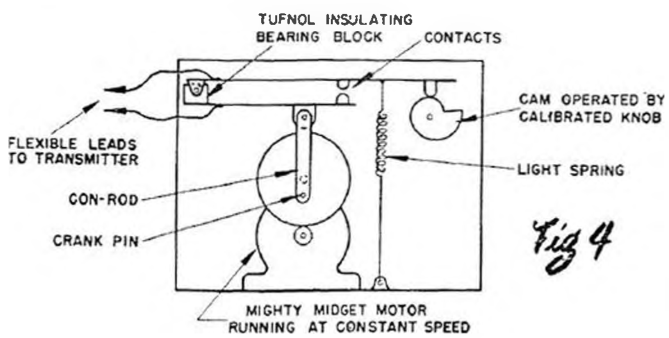


Fig 4

Above: Kurt Stegmaier's vacuum operated actuator system as used so successfully by him at the 1953 and 1954 International Meetings at Evere, nr. Brussells.

Below (and Figs. 3 and 4): World record holder Geoff Pike's 2-control servo unit, which was the prototype for the commercially available Fenners-Pike servo unit.

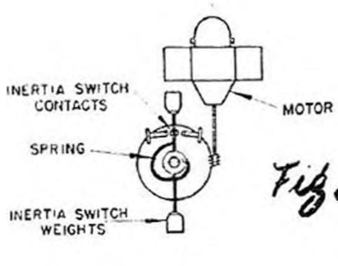
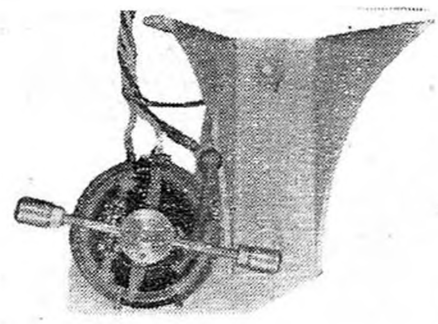
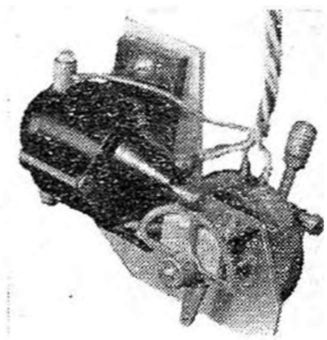


Fig 3

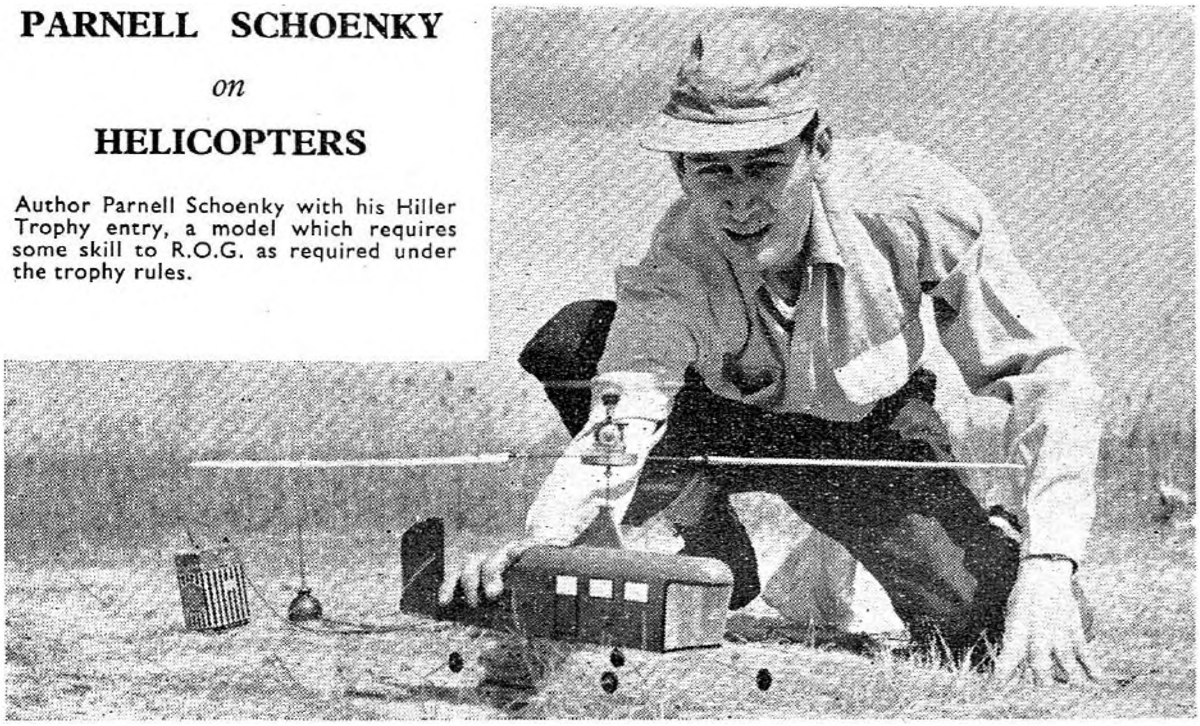




PARNELL SCHOENKY

on

HELICOPTERS



Author Parnell Schoenky with his Hiller Trophy entry, a model which requires some skill to R.O.G. as required under the trophy rules.

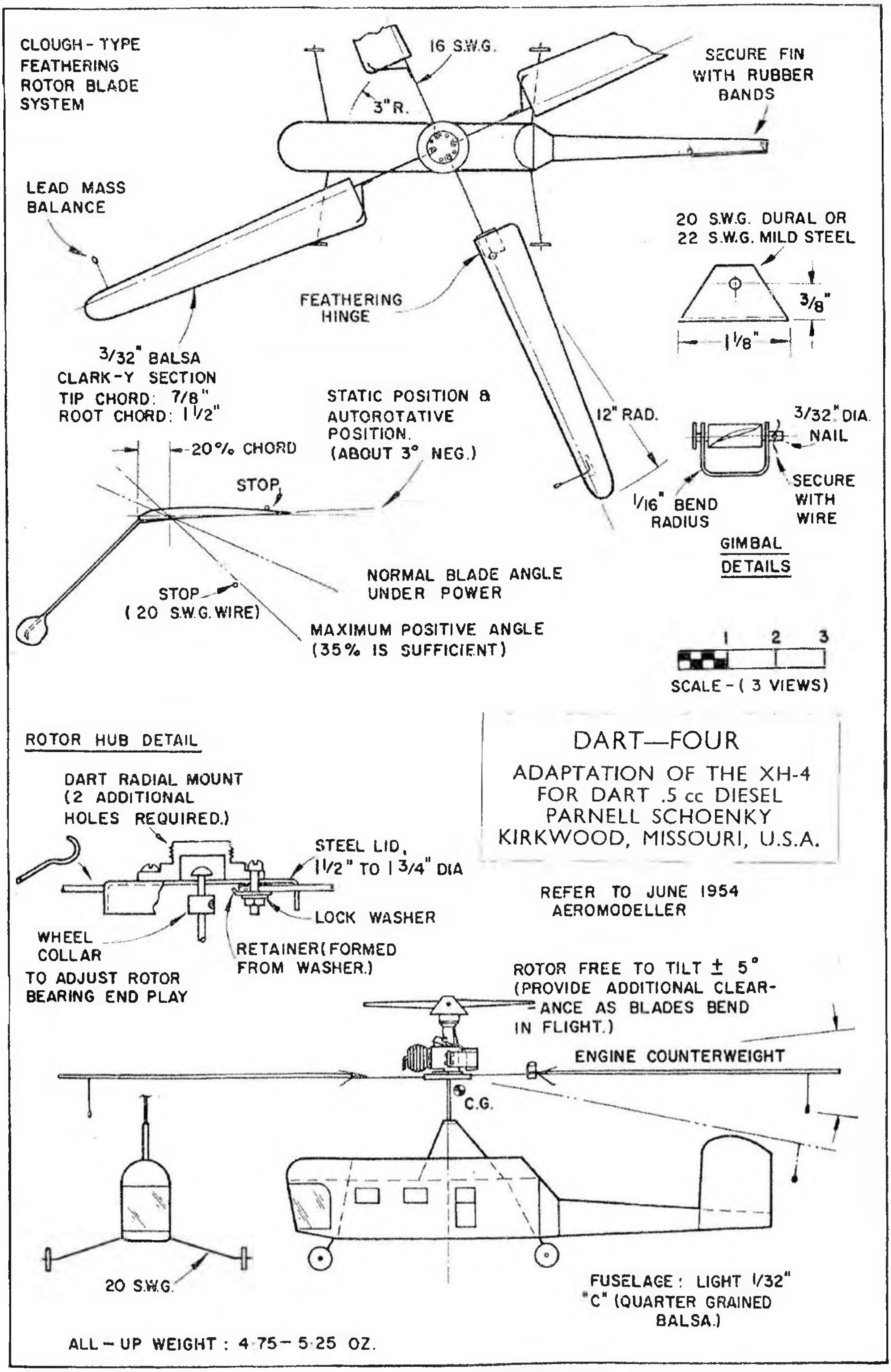
As model helicopters are taken up by greater numbers of aeromodellers, we shall see certain configurations become well established, much as pylon models dominate the power field. At the present time, however, we are still at that happy stage of helicopter development which might be described as "early experimental." The many hundreds of modellers who, we hope, will apply their diverse talents to the helicopter field should be encouraged to make free with their ingenuity, for helicopters bring forth new and peculiar problems. Once enthused, modellers can be depended upon to do a great deal of experimenting with new types; there remains only the problem of getting them started off on the right foot. To this end we offer two designs of proven ability, each utilising the currently most advanced rotor system in its field.

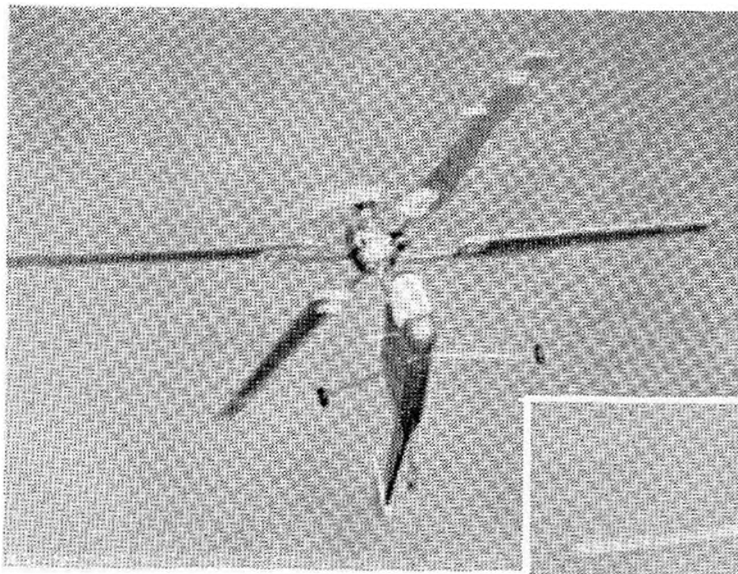
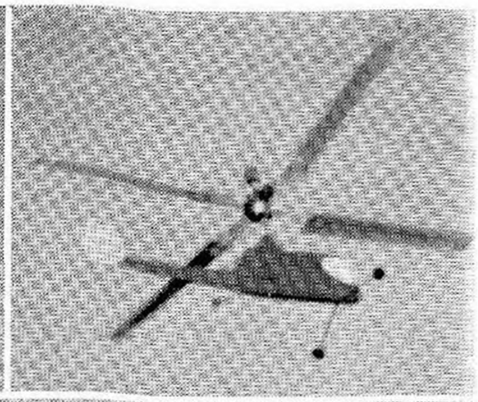
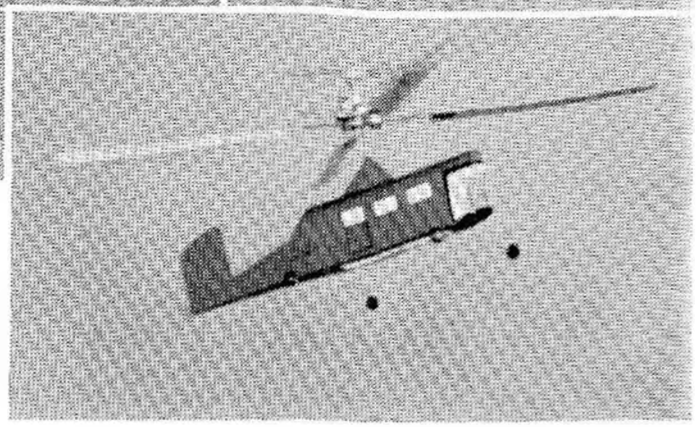
THE "DART-FOUR" POWER HELICOPTER

This design has proven to be a lively performer and also a quite stable craft under normal conditions. The size and weight of this model is tailored to engine performance; the Dart will power a larger model than will the average .5 c.c. engine. To keep the all-up weight under the limit shown, use care in selecting the wood and minimise the use of colour dopes and of solder.

The C.G. is shown in approximately the position required to trim the model for pure vertical flight. The tail-down moment due to C.G. position is balanced out by the relatively greater slipstream drag of the forward fuselage. When the model is ballasted slightly nose-heavy to induce a fair amount of forward flight, then the fin may be offset so as to cancel out the fuselage spin (caused by the slipstream) as well as trimmed to circle the model in either direction.

Auxiliary fins or airfoil surfaces, which may be installed on the fuselage as a means of counteracting the slipstream torque on the fuselage, must be designed so as not to contribute to fuselage drag during forward motion of the helicopter. Therefore, a tilted rear fin or fore-and-aft vanes at the mast level are to be preferred over the lateral vanes (as those mounted on the landing


CLOUGH-TYPE FEATHERING ROTOR BLADE SYSTEM
16 S.W.G.
3"R.
SECURE FIN WITH RUBBER BANDS
LEAD MASS BALANCE
20 S.W.G. DURAL OR 22 S.W.G. MILD STEEL
3/8"
1 1/8"
FEATHERING HINGE
3/32" BALSA CLARK-Y SECTION TIP CHORD: 7/8" ROOT CHORD: 1 1/2"
STATIC POSITION & AUTOROTATIVE POSITION. (ABOUT 3° NEG.)
12" RAD.
3/32" DIA. NAIL
20% CHORD
STOP
1/16" BEND RADIUS
SECURE WITH WIRE
GIMBAL DETAILS
NORMAL BLADE ANGLE UNDER POWER
STOP (20 S.W.G. WIRE)
MAXIMUM POSITIVE ANGLE (35% IS SUFFICIENT)
1 2 3
SCALE - (3 VIEWS)
ROTOR HUB DETAIL
DART—FOUR
ADAPTATION OF THE XH-4 FOR DART .5 cc DIESEL
PARNELL SCHOENKY KIRKWOOD, MISSOURI, U.S.A.
DART RADIAL MOUNT (2 ADDITIONAL HOLES REQUIRED.)
STEEL LID, 1 1/2" TO 1 3/4" DIA
LOCK WASHER
REFER TO JUNE 1954 AEROMODELLER
WHEEL COLLAR TO ADJUST ROTOR BEARING END PLAY
RETAINER (FORMED FROM WASHER.)
ROTOR FREE TO TILT ± 5° (PROVIDE ADDITIONAL CLEARANCE AS BLADES BEND IN FLIGHT.)
ENGINE COUNTERWEIGHT
C.G.
20 S.W.G.
FUSELAGE: LIGHT 1/32" "C" (QUARTER GRAINED BALSA.)
ALL-UP WEIGHT: 4·75–5·25 OZ.

Above left: XH-6 same size model as XH-4, but powered with .8 c.c. McCoy diesel. *Above right:* Another shot of XH-6. *Lower right:* XH-4 lifting a payload. The ballast rack is visible across the open fuselage bay.

gear) for a model which is to be trimmed for forward flight. The main fin is shown in the position for a straight ahead 75° climb, with a bit of clay added to the nose.

Always apply ballast in small increments when trimming this type of helicopter. Too high a forward speed will tend to unload the rotor, in which event the rotor will speed up and lessen its ability to recover from air disturbances.

STABILITY

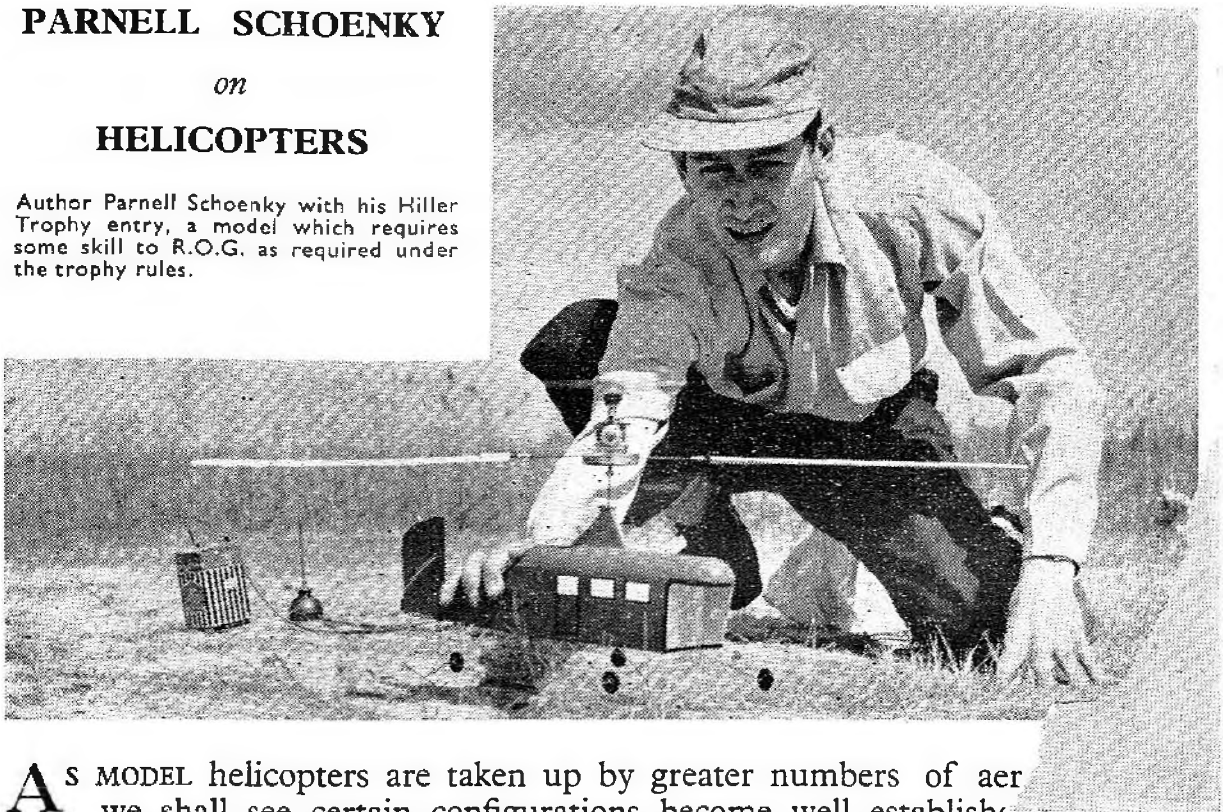
The behaviour of a helicopter in turbulent air is not so simple a matter to analyse and control as it is for ordinary models. The conventional craft, flying along at 10 to 15 miles per hour, passes through disturbed air masses in a period of two or three seconds and its inherent longitudinal and lateral stability is sufficient to keep it on an even keel. Ground turbulence, which produces very tricky air currents close to the ground and may extend up several hundred feet in some terrain, takes on new importance to the 'copter modeller. One of the simple reasons why the helicopter appears to react more sharply to turbulence, is that it moves so slowly through the air, and may even hang suspended in mid-air for half a minute or so. In this situation it may be subjected to tumbling forces for quite a period. It cannot, therefore, be expected to ride out the gusts like a conventional fixed-wing model. When a gust of sufficient force or duration does tip a feathering rotor design beyond what the gravity-referenced stability system can cope with, the rotor blades appear to flutter and stall—and the rotor speed drops abruptly from about 150-250 r.p.m. to zero. Here is where power and altitude come to the rescue; the ship wallows and sinks slowly on the thrust from the propeller until engine torque can bring the rotor back up to speed.

The other important thing to remember when analysing helicopter

PARNELL SCHOENKY

on

HELICOPTERS



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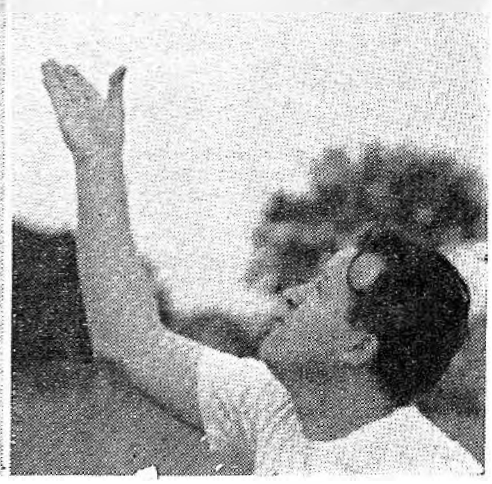
Auxiliary fins or airfoil surfaces, which may be installed on the fuselage as a means of counteracting the slipstream torque on the fuselage, must be designed so as not to contribute to fuselage drag during forward motion of the helicopter. Therefore, a tilted rear fin or fore-and-aft vanes at the mast level are to be preferred over the lateral vanes (as those mounted on the landing stability is that the 'copter is a more complex device dynamically than the ordinary type of model. The major and minor rotors are powerful gyroscopes, of course, and bring with them problems which we otherwise have to deal with only in the case of high r.p.m. power models. In addition, the helicopter has many flexing and pivoting masses, each with its own natural frequency of vibration. These oscillations and their harmonics can interact and build up into some very troublesome forces. The more parts which are kept short and stiff, the fewer will be the vibrations which can flutter rotor blades or shake the fuselage.

The stability of your model helicopter may be checked in a rather simple manner by making backyard flights on about six feet of string, secured below the C.G. By means of this "kite flying" method, one may easily test a large variety of fins and control surfaces at various settings. Though it is straying a bit far from the field of freeflight, the modeller may later install a more elaborate set of cables and manoeuvre the model about within reasonable limits.

There are several trends evident in the design of feathering-rotor power helicopters, (*a*) the type with the large fuselage and small main rotor, and (*b*) the type having a moderate rotor diameter and a short fuselage which does not extend past the blade tips. The lifting efficiency and the stability characteristics of each type are somewhat different, as we shall see. Both, however, can be considered to gain the greater part of their lift from the small propeller and just about all of their inherent stability from the main rotor. Type (*a*) with its large pendulant fuselage is quite stable up to a point, but has difficulty in recovering when finally tumbled by air currents. Type (*b*) depends more upon the rotor system for stability and, with its light short-coupled fuselage, responds much more readily to righting forces. The latter type descends more slowly during autorotation as a result of its lower disc loading. The rotor diameter and weight

Below: XH-4 ballasted and trimmed for forward flight. *Right:* Ed Linthicum handlaunches XH-4 with a ballast load and engine running rich. This shot was taken at 1/400th second with an old focal plane Graphlex, which seems to stop the blades better than a between-lens shutter. (*Photos: Author and Ed Linthicum*).



are governed by the available engine torque and power; if the rotor becomes too large, the resulting drag and inertia will lower the r.p.m. and adversely affect climb and stability. The importance of installing a good engine on your helicopter can scarcely be overstated. Following is an example of how a hypothetical helicopter would behave under various power settings. Suppose that our 'copter weighs exactly 10 ounces, and that its lift, up out of the ground cushion, is 10½ ounces on a cool evening. This excess of lift over weight will climb the model slowly in dead air. Now if the lift is increased a mere 6 per cent to 11 ounces, the rate of climb will be increased nearly 100 per cent. Let us return the engine to its original setting and attempt to fly the model R.O.G. on a hot day. The model will labour off the ground only to the limit of its ground cushion effect (roughly one rotor diameter) and then flounder about in uncertain fashion. The reason for this loss in performance is that the engine is now producing slightly less H.P. just at the time when the rotor, now operating in the less dense warm air, requires more power to do the same job. Now let us lean out the engine or remove ballast from the model in order to increase the excess H.P. (that power in excess of the power required to hover in mid-air) and thereby increase the rate of climb to that achieved previously with 11 ounces total thrust. The model climbs, perhaps to twenty feet, and then meets turbulent air which tilts it 15 or 20 degrees from the horizontal. The vertical component of lift, that part of the total lift which resists gravity, is now reduced to about 95 per cent of its original value and the model sinks. The additional loss of lift due to blade feathering, combined with the time delay before the model can right itself, can easily result in a crash under power and perhaps a broken blade. A reasonable amount of excess lift to design for is 30 per cent of the model's all-up weight. Static thrust may easily be checked by tethering the model to a small spring scale with a few inches of spring.

THE JETEX "JH-2"

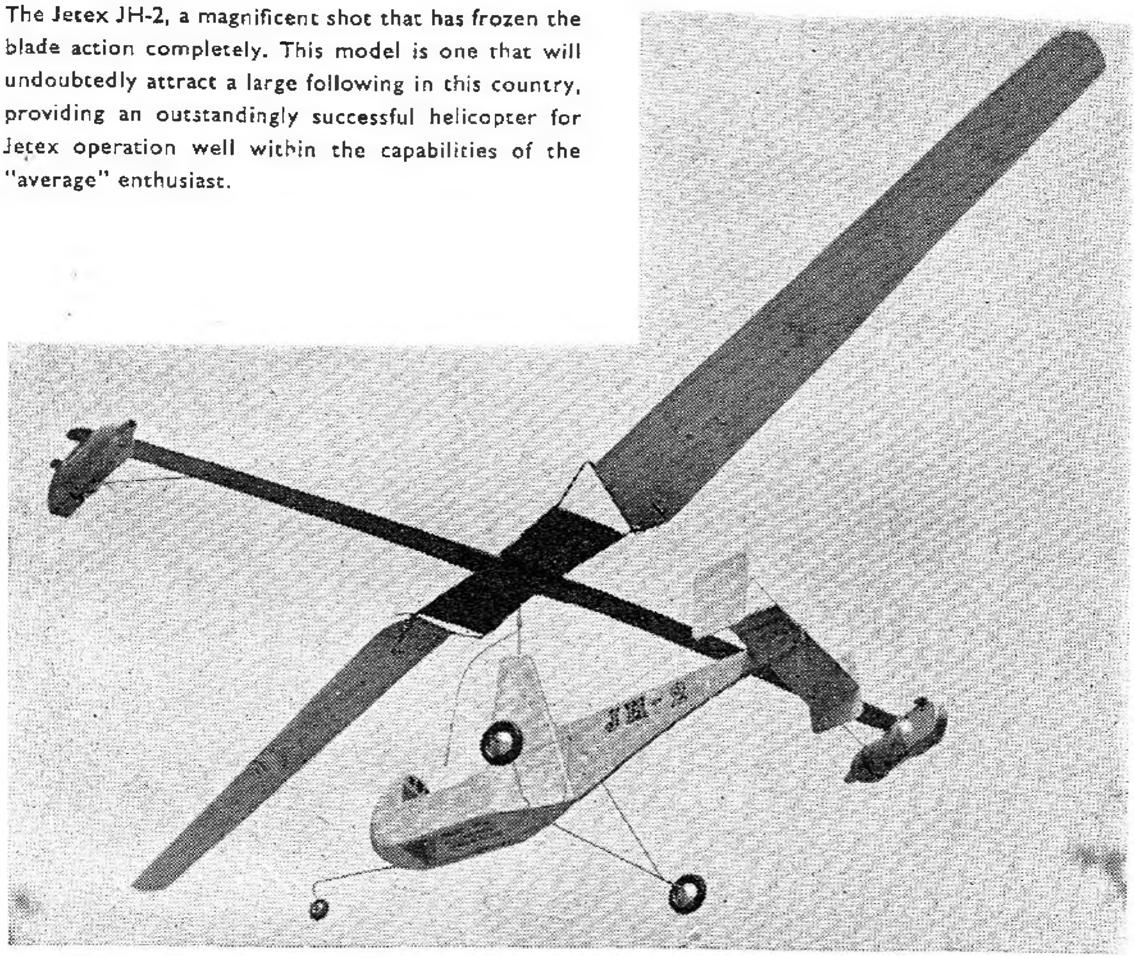
This little jet-powered helicopter is modelled after several single-place helicopters of the type which utilise tip-mounted ramjets or pulsejets to spin their rotors. Aeromodellers would like to mount their Jetex units in similar fashion in order to simplify the structure and to obtain high jet efficiency. However, the necessity of employing a highly stable configuration has led to the development of the now-familiar separate motor boom layout. The angle at which the blades are hinged (called the "skew angle") as seen in the plan view is not critical and so it is permissible to bend the hinge wire as required, in order to trim the 'copter for its best climb.

The Jetmaster Jetex units lend themselves well to this installation, being streamlined, of neat appearance, and not too difficult to attach to the boom. It is imperative that these or any other jet units be very carefully secured to the boom. The rotor r.p.m. of most Jetex-powered helicopters is much higher than that of power models and consequently the centrifugal forces are much greater.

Bearing friction tends to spin jet helicopters fuselages but the force is rather small and may be cancelled out with properly trimmed tail surfaces. The JH-2 flies nicely with just enough nose ballast to induce a forward velocity of about 4-5 m.p.h.; this is sufficient to bring the fins into action and hold the model on its heading.

An assistant to help light the fuses is practically a necessity for it is

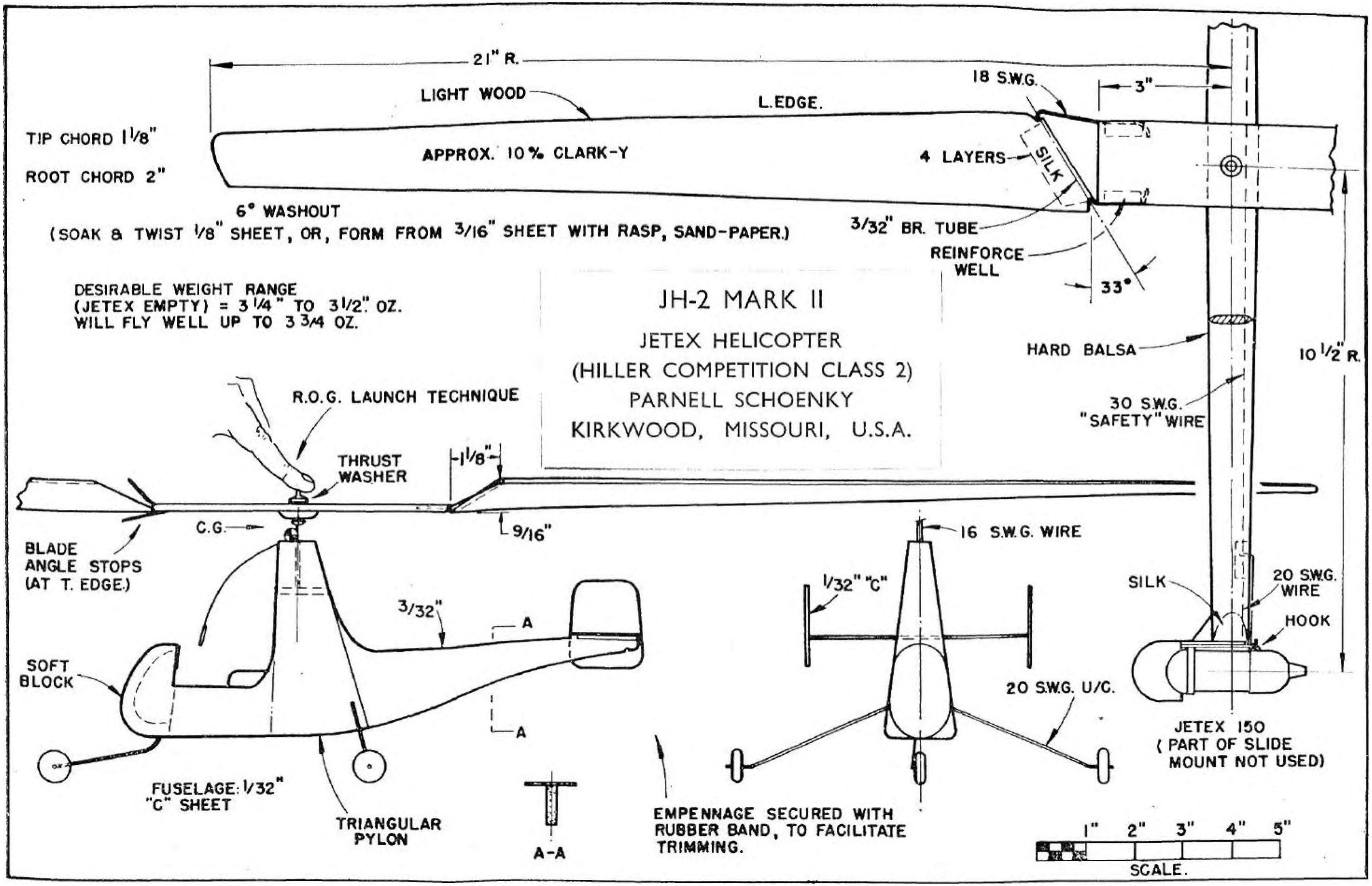
The Jetex JH-2, a magnificent shot that has frozen the blade action completely. This model is one that will undoubtedly attract a large following in this country, providing an outstandingly successful helicopter for Jetex operation well within the capabilities of the "average" enthusiast.



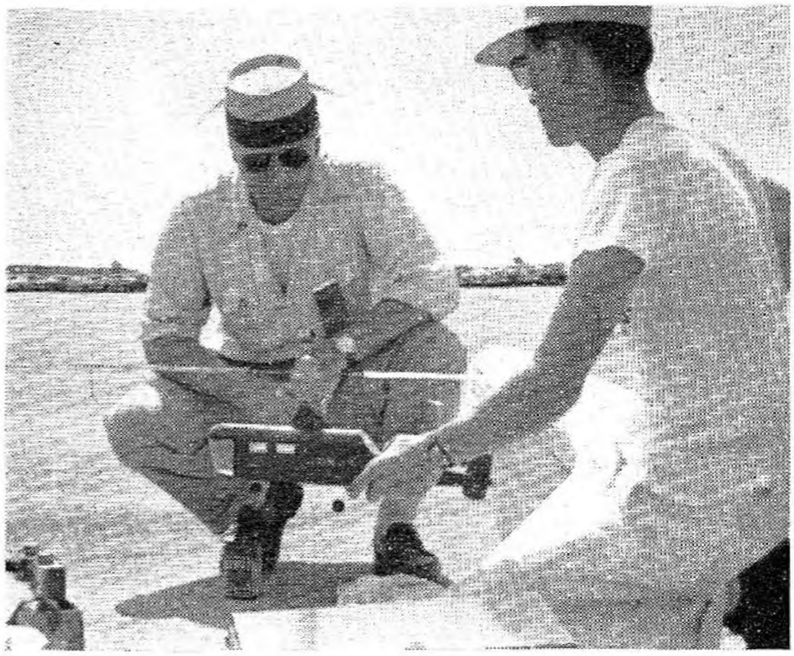
important that both Jetex units be fired off simultaneously. Even with the best of preparation, it will be found that occasionally one of the two Jetex charges will fail to ignite promptly or perhaps may burn unevenly. These conditions give rise to severe vibrations with a frequency of the order of 8 or 10 cycles per second. One effect of this vibration is to increase bearing friction; another is to place great stresses on the skewed hinges, which should be reinforced with this in mind. Yet another effect of this rotor inbalance, and perhaps the most annoying of the lot, is the tendency of the fuselage or landing gear to vibrate in resonance. The best way to avoid such an occurance is to use a very short, stiff rotor mast, stiff landing gear struts, and light balsa wheels.

Wire stops are provided to limit blade droop on the ground and to limit the coning angle of the blades during autorotation. Theoretically the latter are not needed because of the effect of centrifugal force on the blades, but it has been found advisable to limit the upward angle so that the model cannot get into serious trouble in turbulent air. The outer half of the blade span must be at a slight negative angle of attack when the blades are coned upwards for the rotor to function properly and let the model down slowly. This will require that the blades assume an angle of approximately 30° with the horizontal. This may appear excessive to the eye, but actually very little projected disc area (the area swept out by the blades) is lost.

When helicopters of this type are flown in events using the new Hiller model Helicopter Competition rules, R.O.G. takeoffs are required. We manage this by reaching over the top of the rotor and pushing down on the mast tip. Models for the Jetex "350" and "600" will require the use of a stick to extend



21" R.
LIGHT WOOD
L. EDGE.
18 S.W.G.
3"
TIP CHORD 1 1/8"
ROOT CHORD 2"
APPROX. 10% CLARK-Y
4 LAYERS
SILK
6° WASHOUT
(SOAK & TWIST 1/8" SHEET, OR, FORM FROM 3/16" SHEET WITH RASP, SAND-PAPER.)
3/32" BR. TUBE
REINFORCE WELL
33°
DESIRABLE WEIGHT RANGE
(JETEX EMPTY) = 3 1/4" TO 3 1/2" OZ.
WILL FLY WELL UP TO 3 3/4 OZ.
JH-2 MARK II
JETEX HELICOPTER
(HILLER COMPETITION CLASS 2)
PARNELL SCHOENKY
KIRKWOOD, MISSOURI, U.S.A.
HARD BALSA
10 1/2" R.
30 S.W.G. "SAFETY" WIRE
R.O.G. LAUNCH TECHNIQUE
THRUST WASHER
1 1/8"
9/16"
C.G.
BLADE ANGLE STOPS (AT T. EDGE.)
16 S.W.G. WIRE
1/32" "C"
SILK
20 S.W.G. WIRE
HOOK
3/32"
A
A
SOFT BLOCK
20 S.W.G. U/C.
JETEX 150
(PART OF SLIDE MOUNT NOT USED)
FUSELAGE: 1/32" "C" SHEET
TRIANGULAR PYLON
A-A
EMPENNAGE SECURED WITH RUBBER BAND, TO FACILITATE TRIMMING.
1" 2" 3" 4" 5"
SCALE.



The XH-4 Hiller Event entry being examined by Frank Zaic prior to an official flight. Frank assisted in the ROG releases by holding down the tail—the lift was that great. (*Photo: P. Sotich.*)

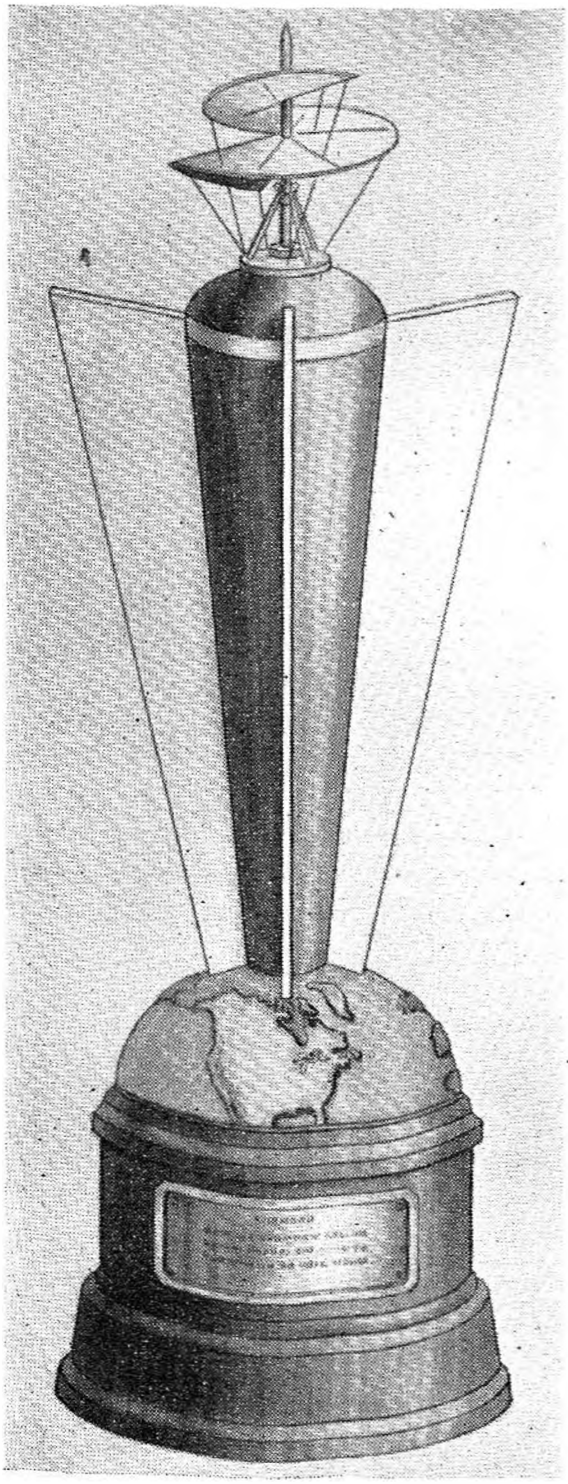
one's reach, for rotor diameters of the latter models often exceed six feet. Ground effect adds greatly to the lift of rotors operating so close to the ground. This means that the jet 'copter will jump off rapidly, forcing the launcher to make a quick retreat.

FUTURE DEVELOPMENTS

Helicopters, speaking of full scale craft for just a moment, have lagged behind fixed wing development for some sixty years. In part this can be traced back to the turn of the century, when the state of the arts of powerplant design, structural design and aerodynamics favoured the progress of what we call conventional aircraft. The Wrights and others broke through the "gravity-barrier" and the world followed like the sea through a tiny hole in the dyke. Our present helicopters, while capable of amazing maneouvrability and good performance, do so at a great price in manufacturing and operating costs. Only the Military and a few qualified civil operators can afford to employ them. Yet, man's past experiences with other engineering developments tells us that machines capable of vertical and hovering flight need not be forever tied to low payloads, complicated mechanisms, and skilled pilots.

The small ramjet and pulsejet helicopters point the way. We of the modelling fraternity might well be the ones to develop the principles of a new breed of simple, inexpensive, inherently stable rotary-wing craft. We need to work out new stability systems which will enable our models to ride out gusts and turbulence equivalent in effect to 125 m.p.h. gales acting upon full-scale craft. The range of the feathering rotor system may be extended by such measures as dampening blade oscillations, applying turbine-type torque assists to the main rotor, and the redesign of rotor components to change the rate of response to disturbances. The feathering rotor system, being referenced only to gravity and rotor r.p.m., tends to fail when upset too far. We have seen model 'copters descend beautifully, inverted. Other models observed have terminated nice cruises with whistling dives.

New propulsion systems should also be a goal of model helicopter designers. The engines of power 'copters should be installed in a less exposed manner, perhaps returned to the inside of the fuselage. There are many novel avenues of approach open to the jet experimenter. Pressure jet rotors, in which hollow blades are used to duct high pressure gases from a central source to jet nozzles at the blade tips, are a promising full-scale development which can be easily adapted to model work. An advantage of this system, using Jetex motors to supply the gas, is that it eliminates the possibility of rotor inbalance resulting from uneven burning. Several structural members would be eliminated, and the drag of two rather blunt engines would also no longer be a factor. However, central pressure jets will involve duct losses, duct corrosion, and will necessitate thicker and more rigid blades. Full-scale designs now employ either rocket fuel, turbojet compressor air, or centrifugal blowers operated by reciprocating engines to supply the air. For models, Jetex appears to be the best gas source at present, but a good centrifugal blower driven by a high-speed glo-engine should have sufficient efficiency to enable it to power a light model. Blade and duct design will have to be worked out rather carefully. Models intended eventually for Hiller Helicopter Competition cannot have metal blades, but this provision would probably not rule out light aluminium tubes which are well padded fore and aft by the balsa fairings needed to complete the airfoil contour. Jetex gases, which expand rapidly and mix with the surrounding air, are not dangerously hot. If the duct root is so arranged that the jet blast can pump air along with it through the blade duct then metal ducting may not be required. Simply coating the walls of balsa ducts with sodium silicate solution is suggested. Large ducts will be required, which will probably result in blade chord increasing greatly, along with a lowering of rotor diameter and the use of symmetrical airfoil sections.

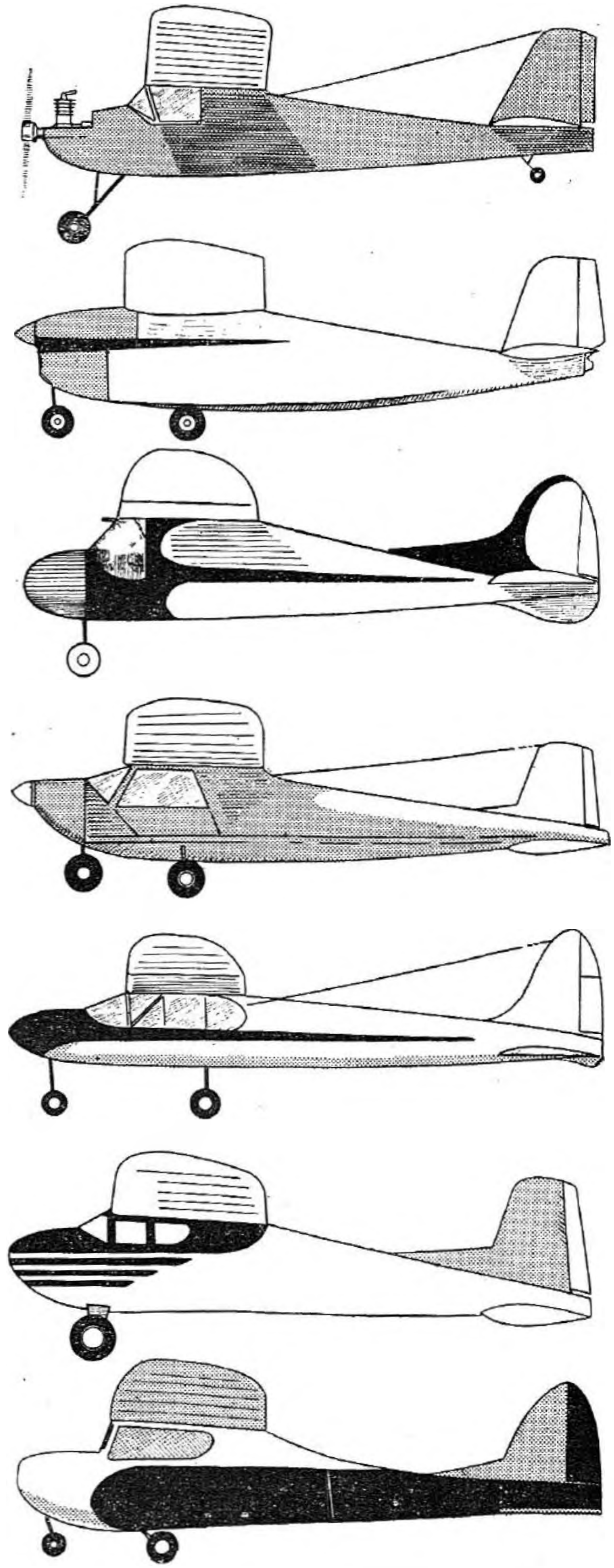


THE HILLER TROPHY—Sketch of 40-inch trophy to be awarded in the Hiller Model Helicopter Event has inscription "Awarded Annually for Outstanding Achievement in Model Helicopter Flight," and places to list winners.

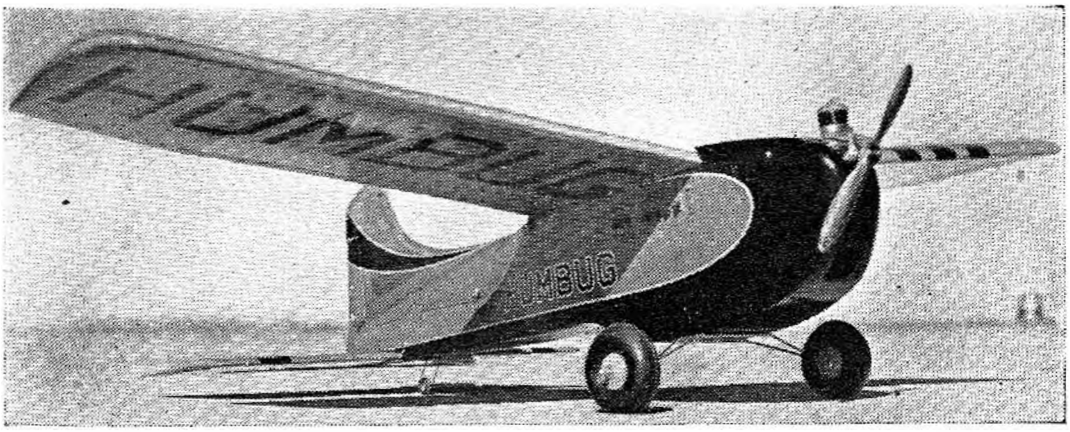
RADIO CONTROL DESIGN

THE average sports type free-flight power design normally makes quite a reasonable radio-control model, albeit with a strictly limited performance. Usually a "conversion" of this nature results in a model which is pleasant to fly, responsive to controls and capable of being kept well within bounds in good flying conditions. Stability is generally poor if turns are held on, so that level turns have to be accomplished by "blipping" the rudder in the required direction of turn. But the over-riding disadvantage of all models of this type is that they have low penetration against a headwind. Hence they drift downwind to an alarming degree in any appreciable drift, limiting the manoeuvres which can be performed under such conditions. If the wind is strong, then the flight usually resolves itself into an into-wind battle, keeping the model flying on a straight (upwind) course. Loss of ground distance resulting from a 360 degree turn (accidental or intentional) may mean that a return to base is impossible.

Considerable advances have been made in the design of radio-control *equipment* during the past few years but, in this country at least, there has been no comparable advance in the design of radio-controlled *aircraft*. In other words, the bulk of the development work has been concentrated on the radio side, and model performance tends to be just as limited as it was when radio flying was



Simple adaptation of cabin-type sports models are good for calm weather flying. Multi-control systems called for special designs with symmetrical aerofoils—essentially functional layouts. Lighter cabin sports models came into their own with lightweight radio gear. The bulky fuselage model now widely favoured, small dihedral, underslung tailplane almost standard.



a novelty some four or five years ago. Thus whilst Britain may produce excellent freelance and commercial equipment for radio modellers we do tend to lag behind several countries, and America in particular, in the application of this equipment.

Radio control modelling splits into three definite sections—the transmitter-receiver system, actuators and servo mechanisms, and model design. Each must be considered with relation to one another, but with the current reliability of the modern transmitters and receivers, an intimate knowledge of electronics and radio circuits is not strictly necessary. The latter two sections are essentially mechanical and well within the grasp of the non-radio-minded aeromodeller and it is within these two sections that there is the greatest scope for development. Producing better radio controlled models is, in other words, a problem for the *aero*-modeller rather than the *radio*-modeller.

The radio side can be considered as nothing more than a mechanical switching device which opens or closes the actuator circuit or circuits as required. The simplest, cheapest and most popular form of radio controlled "switch" is the simple "on-off" type, corresponding to a single channel system which is normally used to operate one control only, in sequence. Other controls can be included in the sequence, by using a suitable escapement unit, but complicated single channel sequence controls are open to serious objection for model aircraft use in that if the sequence is lost the model may get completely out of control and crash.

There are a number of ways in which a simple transmitter-receiver radio link can be modulated to increase the number of switching responses, *i.e.* the number of individual controls available. The type which appears to offer the greatest possibilities, coupled with good reliability, is the tuned reed system where, by the inclusion of resonant reeds, each with its separate relay or "switch" in the receiver, up to six separate control "switches" may be available at the ground station. The main objection is the relatively high cost of such equipment.

From the aero-modeller's point of view it is undoubtedly simplest to consider the "mechanical equivalent" of the receiver as a switch controlling the servo mechanism or mechanisms which produce the actual control movement. The ideal arrangement is a "team" consisting of one partner primarily interested in the radio side and a practical aero-modeller interested mainly in the model side—a combination which should readily be available in many clubs. By contrast a radio enthusiast adapting or evolving orthodox model designs as a means of trying out his radio ideas is not likely to advance the performance of radio controlled model aircraft as much as an *aero*-modeller tackling the same subject with but a minimum working knowledge of the radio side, gleaned from the manufacturer's instructions and experience on the field as he goes along.

As far as model design is concerned, straightforward adaptation of a free-flight "sports" layout usually results in a model which tends to "kite" into wind, *i.e.* climb steadily with very little forward groundspeed; and also shows entirely different response to rudder "engine on" and "engine off." As a consequence, to get enough "engine off" rudder response, rudder movement under power is generally sufficiently large to force the nose down into a spiral dive in less than a 360 degree turn. Incidentally, the "spins" produced by the average radio model are merely prolonged spiral dives. Elevator and motor control is virtually essential to produce a true spin, which must be initiated by a stall.

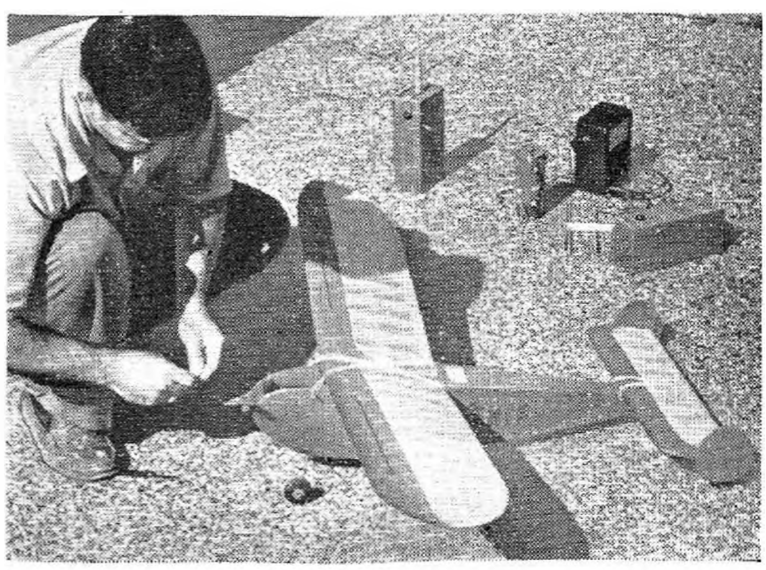
Under-elevating the basic sports model produces a faster glide and will help combat "kiting" (decreasing the wing incidence or longitudinal dihedral is the most effective method). Level turns are possible by "blipping" the required rudder on and off at a suitable rate. Varying the rate can produce anything from a wide, slow climbing turn to a faster, diving turn.

If the model has too much dihedral, a blipped turn will induce a rocking motion—the model rolling in the opposite direction of the turn as soon as the control is released and then into the turn on the next "blip," and so on. On the other hand, insufficient dihedral may induce a sideslip as soon as the model starts to bank and even with "blipping" the model will always lose height on the turn.

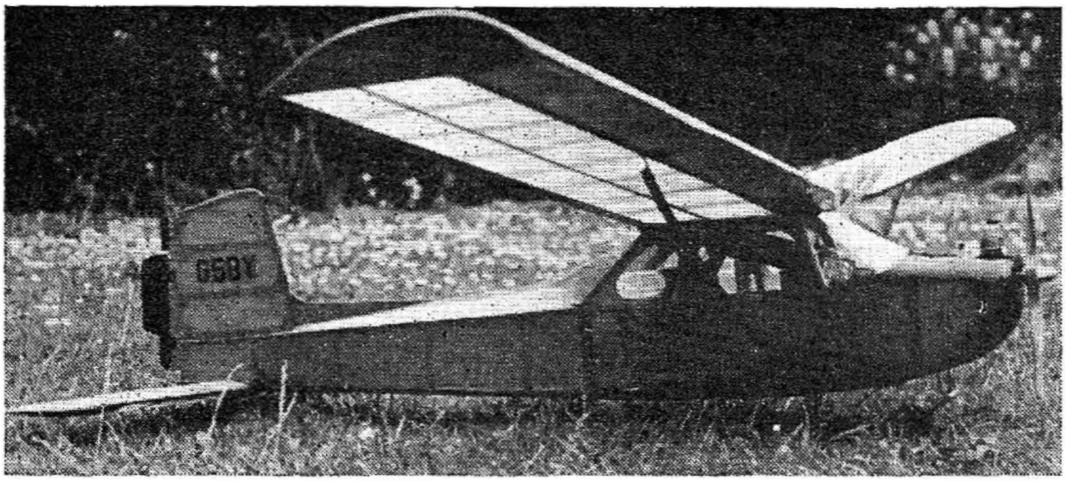
For simple rudder-only control there is definitely a "best" dihedral angle for smooth "blipped" turns. This will vary somewhat with the layout of the model, but is appreciably less than that of the average free-flight model—around 5 degrees. Such small dihedral, however, makes the fin area more critical and the wrong fin area may produce a design which is viciously unstable if a turn is held on. Also with low dihedral a degree or so wash-out on the wing tips is advisable.

Amongst the design features which determine stability in turns are the wing and tailplane aerofoils and incidences, centre of gravity location and the vertical location of the thrust line. Most radio models are rigged in a somewhat under-elevated state, either with small longitudinal dihedral, forward centre of gravity position, or both. Tailplane power, in its action as a stabiliser

"Humbug", a new heavyweight T/C model by Claude McCullough. Weight is 6 lb., span 60 in., chord 12 in., powered by Torp. 32. Receiver operates proportional rudder, motor control and shut-off plus elevator control by escapement with delayed relays.



Gene Foxworthy with his scaled down model of the "Hoosier Hotshot." This is a miniature of the builder's 1950 American Nationals winner, has an area of 350 sq. in., and carries a total of 28 oz. Sweet performer with nice glide in spite of heavy Citizenship receiver.



H. L. O'Heffernan's Mills .75 powered "Skyskooter" which has flown for 1 hr. and 35 sec., consuming only 3½ oz. of fuel! Submitted as a world record this flight was beaten by a Russian claimant prior to ratification.

varies with different flight attitudes due to the changing downwash effect from the wings. Thus, nosing down and picking up speed, downwash decreases and the effective incidence of the tailplane increases, tending to make the model even more under-elevated. A reasonable degree of longitudinal dihedral is therefore necessary for safety, even if this is in direct conflict with the requirement to prevent "kiting." A high thrust-line can be used instead.

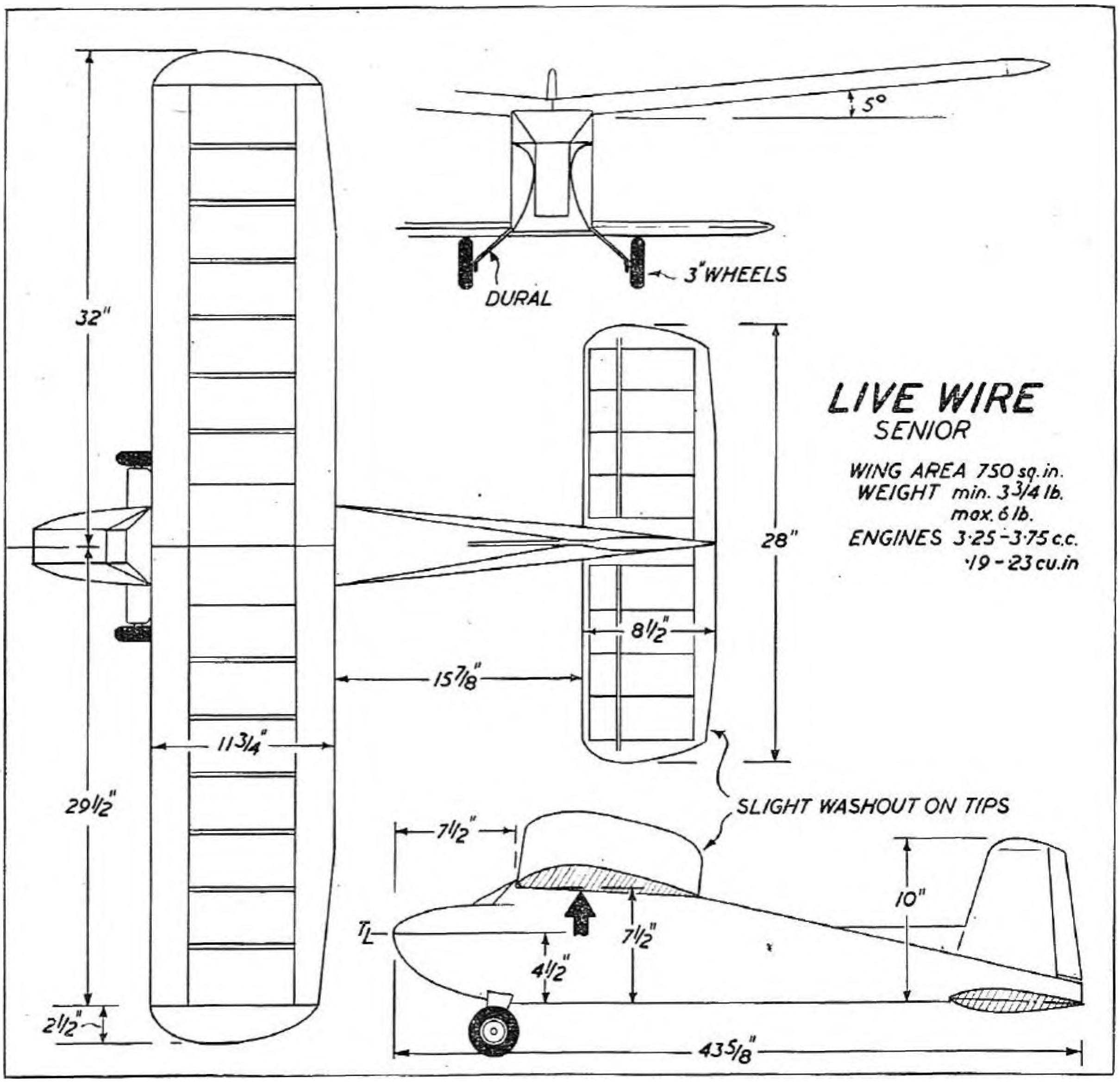
The form of the aerofoils themselves also play their part. Although radio model aerofoils are seldom considered very critical it is quite common to employ a thick wing section and a thin tailplane section. A thick wing section is good from many points of view—adequate depth for spars, good lift to support a relatively high wing loading, etc. . . . On the other hand it may appear good practice to employ a thin tailplane section for low drag, but this is something of a fallacy. It appears that the balance struck between the thickness of the wing section and of the tailplane section has a lot to do with smooth recoveries from turns, particularly into wind. A thick wing demands a thick tailplane section, possibly of the same or even greater order of thickness. To ensure that the section itself is not critical, this virtually demands a symmetrical tailplane aerofoil. Thus the turn recovery of a model fitted with a 10 per cent. thick tailplane may often be improved considerably by replacing the tailplane with a symmetrical 15 per cent. thick section of the same area. Harold de Bolt has confirmed that his 48 in. span *Live Wire "Trainer"* with a thin symmetrical tail is far inferior on turn recovery to the larger (virtually scaled up) *Live Wire "Senior"* with a 15 per cent. thick tail.

The *Live Wire* is undoubtedly one of the outstanding radio control model designs. It was first evolved through a series of experimental models some three years ago, subsequently marketed in kit form (in the United States) in 34, 48 and 64 inch (two versions) span sizes. It is not exactly a pretty model and remarkably different from the average run of "sports" designs. Yet the excellence of the layout has been endorsed by many experts and numerous other successful freelance and commercial designs have appeared on the same lines. For "flyability" with simple control systems, at least, it is well ahead of any other designs with which the writer has had any personal experience.

The bulkiness of the fuselage of the *Live Wire* not only affords ample room for installation of the radio gear and accessories but also provides "built-in" drag—a feature claimed by many American experts, at least, as essential to arrive at a similar balance between "engine on" and "engine off" response and provide a non-floating glide. Walter Good, foremost in combined radio-aeromodelling activities, utilises similar principles in his "*Wog*." The built-in step in the lower part of the fuselage is virtually nothing but a drag-producer. On the other hand we have seen good performances from sleek, streamlined models which fly quite fast, but most do tend to have a "float" on the glide unless underelevated to the point where turn recovery is affected.

The orthodox "sports" cabin layout is still an excellent starting point, especially for calm weather. A *Live Wire* or similar layout does, however, appear a better proposition for an aero-modeller interested in working up to a high standard of proficiency in flying performance because it is better proportioned for manoeuvrability and more nearly a constant-speed machine (engine-on and engine-off).

The basic rudder-only radio model must still possess a good degree of inherent stability. It should return quickly to its normal flying attitude when rudder is neutralised and should also fly straight under power and on the glide with neutral rudder. This ability to maintain a straight course with neutral control setting is important on *any* type of radio model for it means that if

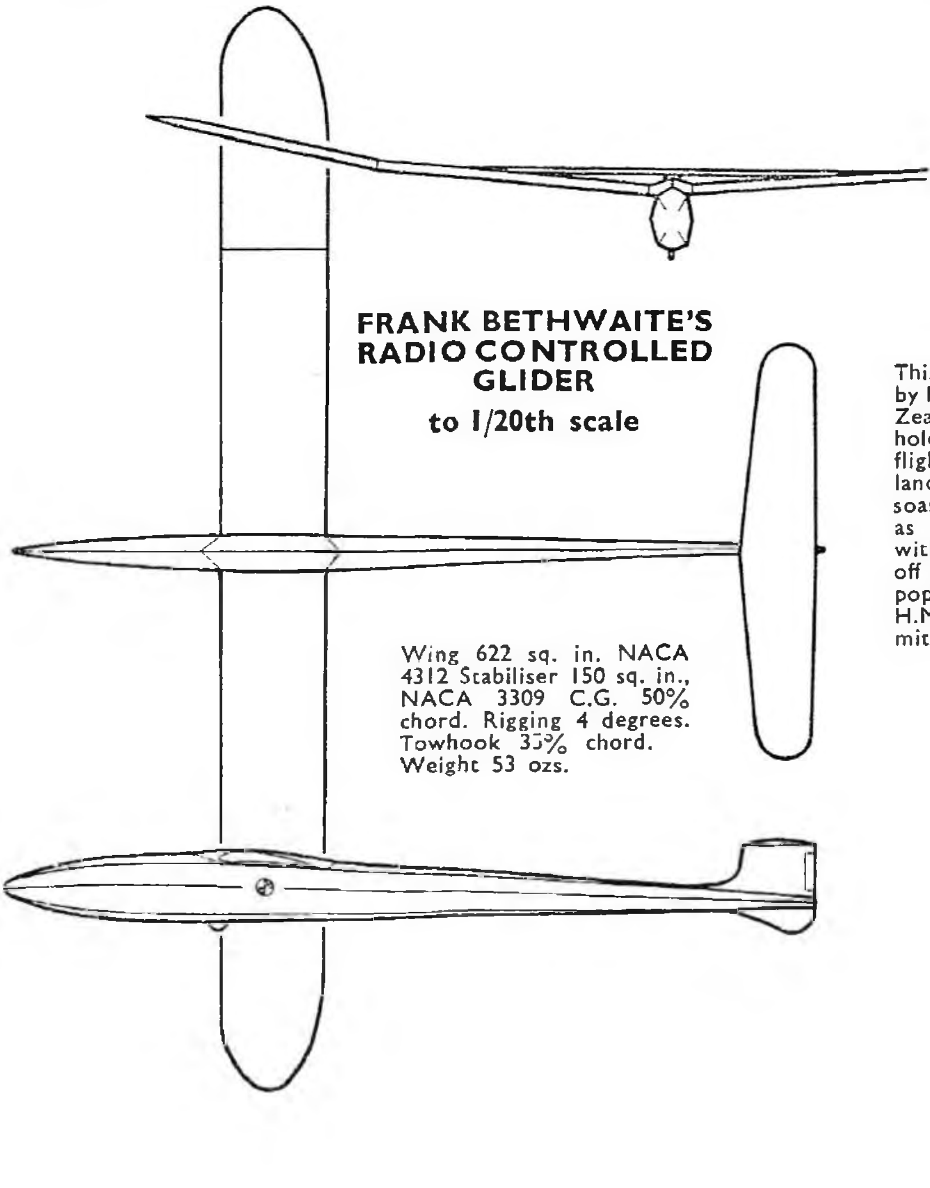


ground is lost downwind the model can be turned upwind and left to come back overhead. Slight right motor offset is usually all that is necessary to trim out a true, properly proportioned model for straight flight. Rudder tabs, if used, make it difficult to get straight flight both under power and on the glide (the tab usually being more effective under power). Better to correct warps or mis-alignment causing the natural turn.

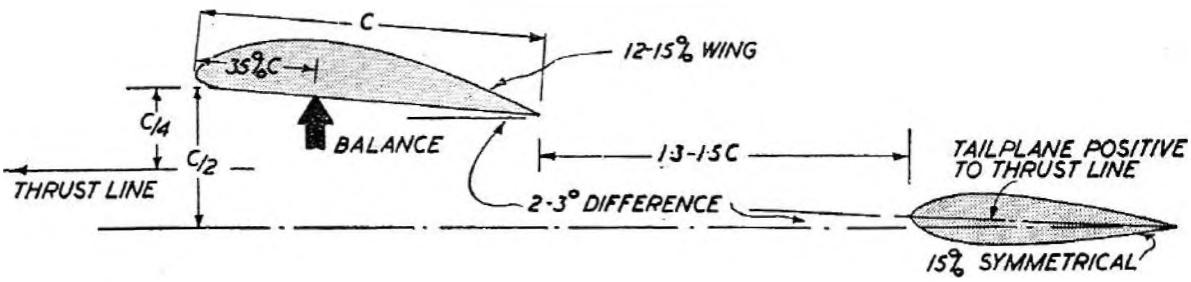
Directional stability of this nature is actually a rather tricky subject. With the low to moderate dihedral angles required, shoulder-wing or mid-wing designs can be very critical on adjustment—too critical to make them satisfactory. Again the high wing layout provides the most consistent settings in this respect.

Radio flying in this country is handicapped by the fact that normally flying conditions are windy and, having proportioned a model for good fly-ability, penetration still remains a major problem. Increasing the flying speed is the only solution to beating upwind against a stiff breeze, which has resulted in the appearance of clipped-wing designs for rough weather flying with flying speeds of the order of 40 to 45 m.p.h. For rough weather flying, however, the potentialities of the rudder-only model appear strictly limited.

Undoubtedly the most satisfactory solution is a model with trimmable elevators. This gives, in effect, a model with a considerable speed range, and



This radio-controlled glider by Frank Bethwaite of New Zealand is world record holder in its class with a flight of 2 hr. and 5 sec. It landed after its long slope soaring flight under r/c as daylight was failing within 130 yards of take-off point. Equipment is the popular New Zealand H.M.V. receiver and transmitter plus Venner accumulators.



also one with enhanced manoeuvrability. Using a simple mechanical system the elevators can be "ganged" to the rudder servo, giving selected elevator positions coupled with rudder, or one of the neutrals. This gives a partial solution without recourse to more complicated radio gear; but a two-channel or "two-control" radio system is to be preferred, even if limited to selecting two elevator "trimming" positions and a neutral. The requirement is elevator trim which can be selected independent of rudder control and held on whilst the separate rudder control is available. Model design requirements remain unchanged, except for the provision of movable elevators hinged to the fixed tailplane.

Given a satisfactory elevator trim control, however, there is no reason why the design should not be advanced a stage further with a view to achieving inverted flight and manoeuvres from the inverted position. Ideally this calls for a model which will fly "hands off" both upright and inverted, with normal manoeuvrability and response to controls unaffected. This means, largely, modification to the aerofoil sections, and possibly to the layout itself.

For satisfactory "upright" performance, a reasonable degree of dihedral must be retained. This becomes, of course, anhedral, in inverted flight with no automatic recovery should a sideslip start from the inverted position. Minimum dihedral can be used on the high wing layout, but even with symmetrical aerofoils, inherent stability in inverted flight will be poor or non-existent. Yet the low-dihedral high-wing layout still appears the most practical solution, reducing dihedral to a matter of 3½ degrees and using no wash-out. With fairly thick (15 per cent.) symmetrical wing and tailplane aerofoils, a normal longitudinal dihedral of three degrees should provide ample upright stability "hands-off," calling for an elevator which can be trimmed over a range of "up" and "down" (preferably) or capable of holding about 10 degrees "down" for trimming out for level inverted flight. Such a model will, however, have to be *flown* all the time it is inverted, correcting any tendency to come out.

Harold de Bolt who has probably done more inverted flying with radio models than anybody else uses what is, basically, the *Live Wire* layout again with the longitudinal dihedral mentioned, rigging the wing at 0 degrees. (Incidently, a published plan of this model "*Over and Under*" is in error in showing the tailplane at 3 degrees *positive* incidence; it should be 3 degrees *negative*.) Power-on upright performance is similar to the other *Live Wires*, with superior manoeuvrability on account of the available elevator control. Glide performance, on the other hand, is not as good.

The third control then necessary to "complete" the fully controllable (and manoeuvrable) radio model is engine control. A two-speed engine would add considerably to the scope, permitting power-on approaches and landings (opening up and going round again, if necessary). An engine shut-off control does not seem as necessary since the model could be brought down and landed with "slow" engine. However, since a two-speed engine control can easily be rigged with a cut-out device (as on the Bonner escapement) there is no reason why this should not be incorporated provided it adds no complication to the radio side. In other words, the problem of providing engine shut-off in addition to speed selection—slow or fast—should be one capable of mechanical solution, not calling for an additional radio channel.

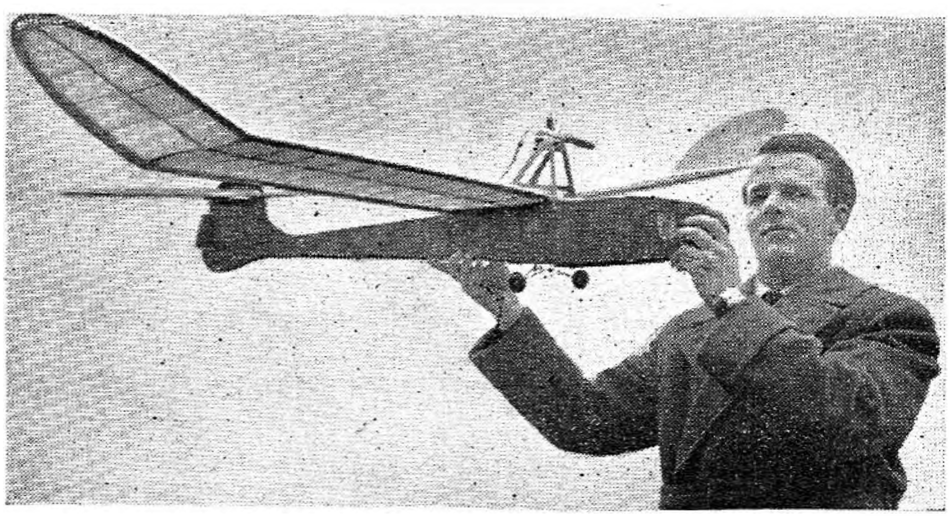
Much could be written on the subjects of actuators and servo mechanisms, etc. Here, in fact, there is a lot of development work waiting to be done. The rubber driven type of escapement has definite disadvantages and limitations and power-operated controls (electric motor or pneumatic) are generally more sound solutions on the more elaborate control installations, although they, too, are not without their problems.

As designs advance, more attention will also have to be given to the design of control surfaces. With trimmable elevators, terminal velocity dives of up to 80 to 90 m.p.h. may become possible, capable of generating aerodynamic forces sufficient to "lock" control surfaces. Aerodynamic balance of the control surfaces may become essential as a safeguard, with possibly mass balancing necessary to eliminate flutter.

At higher speeds, too, rubber driven servo mechanisms may prove quite unsuitable due to inherent flexibility in the linkage. Already it has been shown that *less* control surface area or movement is needed with positive power-operated controls than with escapement-driven surfaces, as checked under static conditions, implying that the latter do not hold their full static displacement under actual flying conditions.

In this country the radio *model* field is wide open. The commercial *radio* equipment is available for the aeromodeller to produce a model with rudder, trimmable elevator and engine speed controls—capable of inside and outside loops, climbing, diving and level turns, horizontal and vertical eights, true spins, etc. It is a field just waiting for the *aero-modeller* to step in so that we can catch up with radio model developments in other countries. If cost limits the amount of radio gear which can be purchased, then the British rudder-only radio model is still capable of vast improvement. Separate contest classifications for these two different types would be a help, and an incentive. But the real answers to the problems lie in the vast number of "performance-minded" aeromodellers who have, perhaps, tired of duration flying.

Geoff Pike with his "Windjammer" powered with .87 Amco engine which holds world r/c record in close competition with a Russian model claim. Time recorded was 1 hr. 32 min. 49 secs.

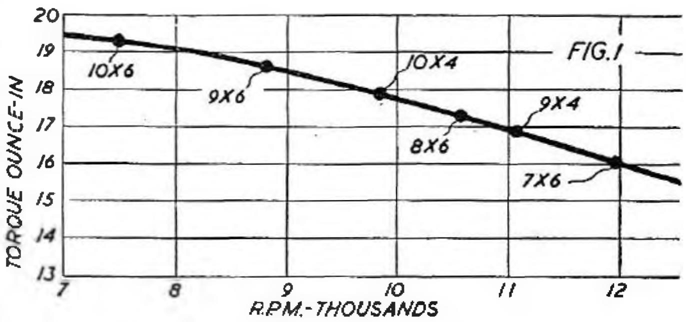


POWER PROPELLERS

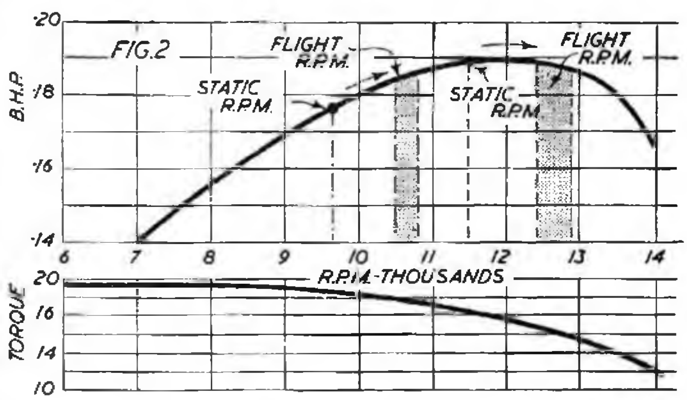
THE AERODYNAMIC characteristics of a propeller are thrust, torque and power absorbed. In simple terms, the torque of a propeller is the moment of resistance which opposes the engine torque and, under working conditions with the propeller rotating at a constant speed, propeller torque is equal to engine torque. Propeller torque, however, is also dependent on the speed of rotation and forward speed and hence is different in flight conditions to static running, and may also vary in flight with changing attitudes of the aircraft concerned.

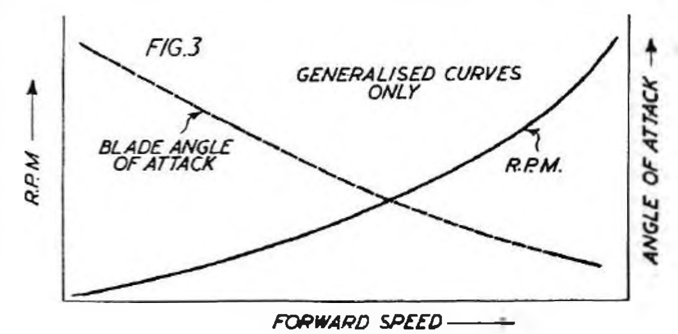
Considering propeller design alongside the performance of a particular engine it will be appreciated that it is the torque curve of the engine, not the B.H.P. curve, which is of major significance. The torque is the available turning force generated by the engine, the torque curve providing a simple means of showing the available torque at any particular engine speed. Brake Horse power is a derived figure and is a measure of the work done by the engine at any particular speed—actually proportional to torque x r.p.m.

Thus considering a typical engine torque curve (Fig. 1) obtained under static test conditions, different propellers (representing different loads) will fully absorb different torques, represented by the fact that these particular propellers will allow the engine to reach a certain r.p.m. The smaller the propeller, logically, the smaller its power-absorption characteristics at the same r.p.m., hence excess engine torque is available to drive it at some higher speed, engine torque tending always to decrease with increasing r.p.m.



Under flight conditions, propeller torque or resistance to engine torque tends to decrease. Hence the same propeller will achieve a higher r.p.m. figure in flight, driven by the same engine. Unfortunately, whilst it is readily possible to measure static r.p.m., no data are available on flight r.p.m. with model propellers and so only estimates can be made as to what this increase in r.p.m. is likely to be. A figure of a 10% increase in r.p.m. has been suggested as an average figure, but no generalised figure can be applied to all designs since the increase in r.p.m. is bound to vary with the type of model and flying trim, i.e., the operating *speed* of the model (see Fig. 3).





From the point of view of an accurate analysis of propeller design requirements, it is the flight r.p.m. figures which are of significance. Hence estimations of this nature are excusable on the grounds that they provide some sort of check on propeller sizes used on a particular model, particularly where maximum performance is the aim.

An engine torque curve and related B.H.P. curve is shown in Fig. 2. It is a well-known fact that engine "peak" at a certain r.p.m. figure. If speeded up beyond this figure then, although the engine may be going faster (i.e., developing more r.p.m.) it is capable of doing *less* work. This means, simply, loss of power. Starting with a propeller which, on static running allows the engine to speed up to an r.p.m. figure only just below that corresponding to peak B.H.P. (maximum power), the increase in r.p.m. under flight conditions due to decreased propeller torque may mean that the engine overspeeds beyond the peak of its power output and the results, in terms of work done or thrust generated may be poorer than anticipated.

Propeller torque can be given in terms of an empirical formula where the torque coefficient (k_q) is a numerical quantity constant for all geometrically similar propellers rotating at zero speed of advance, i.e., static running conditions.

Torque (Q) (ft.-lb.) $= k_q \, n^2 d^5$

where $\rho = .00237$
n = revs. per second
d = propeller diameter (ft.)

Reducing this formula to model units and multiplying out ρ

Torque (Q) inch-ounces $= K_q \, (\text{r.p.m.})^2 \, D^5$, where D is in inches

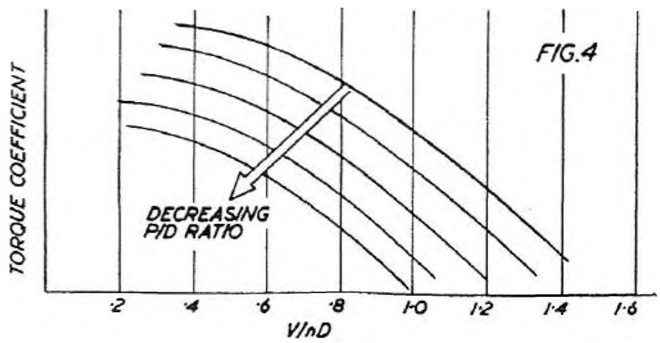
It follows that since a family of commercial propellers should be, essentially, "geometrically similar," one value of K_q should apply throughout the range. Unfortunately this is complicated in practice by variations in workmanship between individual specimens and also the influence of aerodynamic scale effects, particularly as small blade widths are approached. With these limitations, given a "family" torque coefficient (K_q) and an engine torque curve, agreement between theory and practice is usually poor.

The effect of pitch is rather more difficult to estimate. The torque coefficient is obviously affected by pitch since it is well-known that increasing the pitch for the same diameter will absorb more power, thus decreasing r.p.m. and *vice versa.* Most available data on the effect of pitch on the propeller torque coefficient relates variation in K_q (or k_q) to the ratio V/nD, where V is the forward velocity of the propeller, i.e., the effect under working conditions. The effect of a change of pitch on the static r.p.m. achieved may be quite different to the effect under "working" conditions when the propeller has an appreciable forward velocity.

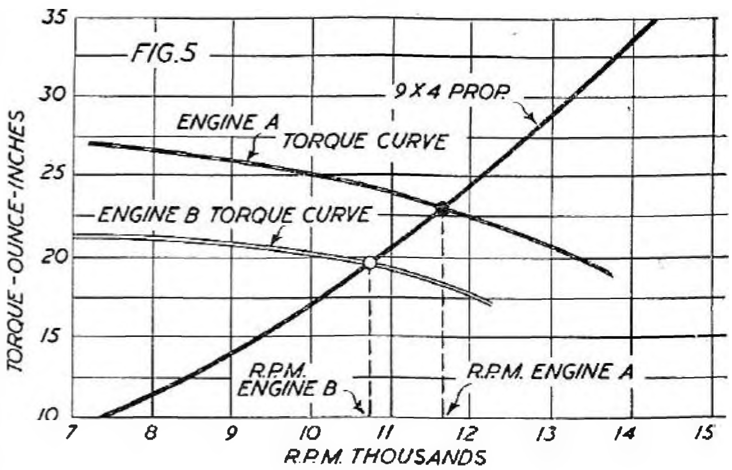
These effects are illustrated graphically in Fig. 3, one curve showing the typical pattern of r.p.m. increase with a fixed pitch propeller over a range of forward speeds; and the other the corresponding variation in blade angle of attack. Curves of K_q related to V/nD follow the pattern shown in Fig. 4.

Primarily it was the original intention of this article to summarise the results of practical tests on various families of commercial propellers with a view to determining K_q values and, if possible, a means of relating pitch changes to likely (static) r.p.m. changes with engines where the torque curve is known. In other words, given an engine torque curve it would then be possible to estimate the r.p.m. obtainable with any particular propeller, provided the "family" torque coefficient for that particular type of propeller was known.

Unfortunately, the numerous practical difficulties which arose with these tests have tended to give inconclusive results, demanding further experimental work, and so the basis of the method only will be described.



It was found necessary to "calibrate" individual propellers rather than try to arrive at "family" torque coefficients. Having obtained an accurate r.p.m. figure with this particular propeller, together with the associated torque, the relative torque coefficient of the propeller can then be calculated. E.g., commercial 9×4 propeller. Engine E.D. 2.46, 10,000 r.p.m. and 17.2 ounce inches torque.



$$K_q = \frac{17.2}{10{,}000^2 \times 9^5} = 2.92 \times 10^{-12}$$

Propeller torque figures corresponding to other r.p.m. figures can then be calculated, as in the following table.

r.p.m.	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000
Q	8.4	11.0	14.0	17.2	20.8	24.8	29.0	33.7

These data can be plotted in the form of a torque-r.p.m. curve, as in Fig. 5. Performance of this particular propeller with any engine can then be estimated by superimposing the *torque curve* for that particular engine over the propeller torque curve. Where the two curves cross, propeller torque equals available engine torque and thus this point is the r.p.m. figure for that particular engine-propeller combination.

Whether this method is valid for model propellers and model engines remains to be proved. In many cases investigated, good agreement was established between theory and practice. In other tests, practical figures differed widely from calculated results.

Differences in manufacturing tolerances have already been mentioned. Another primary source of trouble is bad unbalance in certain specimens and it was generally found that in a range of particular sizes from the same "family" tried on a particular engine, one, or possibly more, gave rise to extreme vibration, possibly, but not invariably, cured by statically balancing the propeller with particular care. Without doubt, for optimum results, all commercial propellers require that the balance be checked, easily carried out with the gadget shown in Fig. 6. The dowel must be a tight fit in the propeller hub and the balance checked on knife edges, e.g., razor blades.

A further source of difficulty was that pitch sizes quoted for commercial

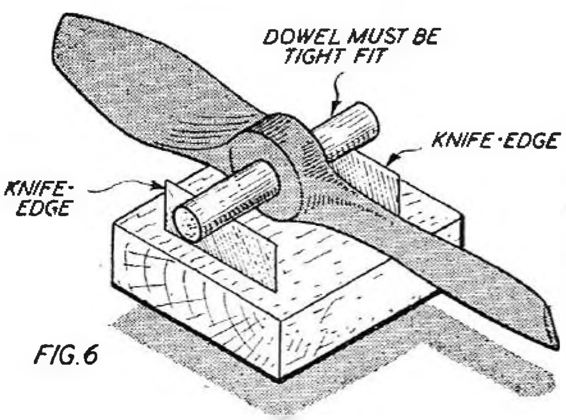


FIG. 6

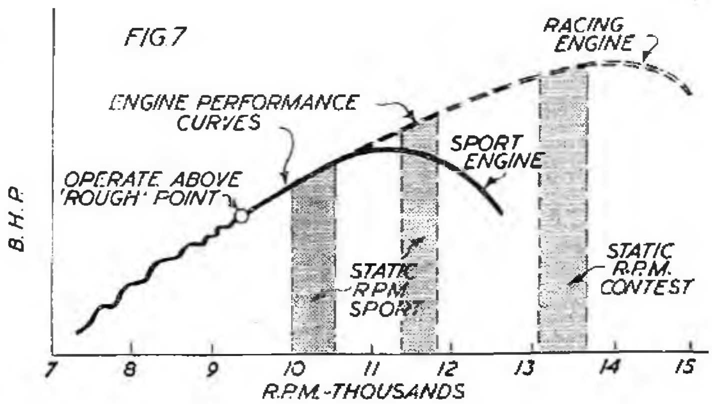
propellers are purely nominal ones, referring to a particular blade element, the distance from the hub of which is not stated. On a constant geometric or true helical pitch propeller, pitch should be the same at all stations from hub to tip. Few commercial propellers come within this category, the majority having a non-helical blade angle change varying along the whole length of the blade. Sometimes the extreme difference between geometric pitch values of a single blade may be as much as 50%.

This does not necessarily mean an aerodynamically inferior propeller for the advantages of non-helical pitch propellers have been described in previous articles. The extent on the non-helical pitch effect on many commercial propellers is, however, open to suspicion on the grounds of efficiency. Generally, pitch is assessed with relation to propeller blank thickness (see Table I) which produces an approximation to a true helical pitch propeller only with certain blank tapers. Variations of this taper are largely responsible for the differences observable in blade angle variation from root to tip.

What is of greater practical significance is that propellers of different brands but of the same (nominal) pitch have quite different actual geometric pitches. Thus, apart from any difference in blade *areas*, quite different r.p.m. figures may be realised with these propellers fitted to a given engine. Table II lists test r.p.m. figures recorded with the same nominal sizes of propellers of different manufacture—all stock articles, un re-touched for balance of smoothness. Apart from considerations of selecting a propeller for a desired operating r.p.m., the resulting different torques from these same (nominal) propeller sizes may seriously affect the trim of a model.

As a general, practical recommendation, therefore, trimming tests, etc., involving selection from a number of alternative propeller sizes should be restricted to a range of the same family or brand of propellers for a start. Fine differences may be realised by reworking the nearest stock size (e.g., trimming the diameter slightly, smoothing and polishing the blades, etc.); or by using a propeller of the same nominal size but another brand. Once a particular propeller size has been established as satisfactory for a model it should always be replaced with an identical propeller (same brand, size and degree of reworking, if carried out on the original).

With virtually no exceptions, commercial propellers pay for re-working where maximum performance is the aim. Smoothing and thinning the blade generally results in lower propeller torque and thus higher r.p.m., an effect which can further be enhanced by polishing or giving the blade a smooth coating. This applies particularly to wooden propellers. Plastic propellers are much improved by filing or grinding out any convexity on the back of the blades, accom-

FIG. 7


panied by polishing to remove any roughness produced by this operation.

Since propeller torque is proportional to (diameter) it is quite obvious that diameter has a marked effect on the r.p.m. obtainable with a particular engine. In other words, to obtain high operating r.p.m., small diameter propellers must be employed. Progressively decreasing the pitch may also result in an increase in r.p.m. for a given diameter size, but the gain is usually less marked unless the propeller diameter is already on the small side.

TABLE II—TYPICAL PROPELLER TEST DATA (SAME ENGINE AND FUEL)

Propeller Size	Brand A	Brand B	Brand C	Brand D	Brand E*
11 × 6	5,700†	6,500	—	—	—
10 × 8	—	5,500†	—	—	7,500
10 × 6	7,500†	—	7,300†	—	—
9 × 6	8,400	8,700	9,800	9,000	—
9 × 4	—	—	10.800	10,000	9,250
8 × 6	10,000	—	11,800	10,000	10,800
7 × 6	12,000	—	13,800	13,750	

* Plastic. † Very rough running.

In any case, simply decreasing the pitch alone may, in the end, defeat its own object. The advance of a propeller under flying conditions cannot be greater than r.p.s. × pitch (inches) feet per second, and is normally appreciably less. It is possible to decrease pitch to such an extent that the maximum available rate of advance is less than the minimum flying speed of the model and hence the engine cannot sustain the model in level flight. This is more likely to happen with the very small engines where the tendency is to employ proportionally larger propeller diameters (if only for adequate "flywheel" effect and ease of starting) and hence, of necessity, find that pitch must be reduced to a very small figure to obtain a reasonable operating r.p.m. Quite a number of these engines develop peak power at very high r.p.m. and power output below about 10,000 r.p.m. is quite poor. Hence the necessity of operating at a minimum r.p.m. figure of at least 10,000. Pitch-r.p.m. characteristics in terms of advance are summarised in Table III.

On the other hand, there has been a popular tendency over the past few years to use propellers of too high a pitch on free flight models. Quite apart from the tendency for a high pitch propeller to reduce r.p.m. by virtue of its

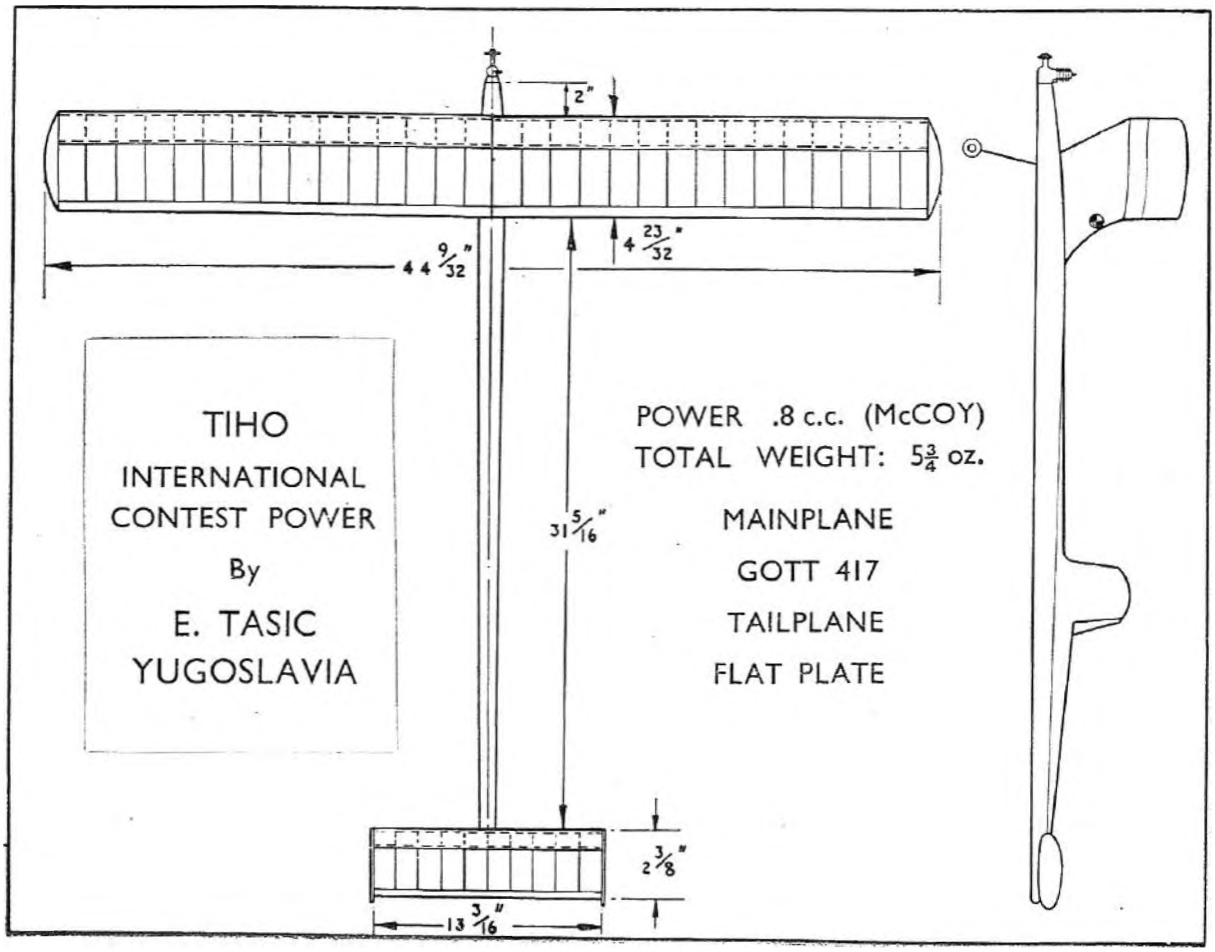
TABLE III—MAXIMUM RATE OF ADVANCE (NO THRUST)—FEET PER SECOND
A Figure of 2/3—3/4 of Tabulated Figures may be adopted for Preliminary Propeller Selection Investigations

PITCH (ins.)	R.P.M. 6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000
1	8.33	9.7	11.1	12.5	13.9	15.3	16.7	18.05	19.44	20.8
2	16.67	19.4	22.2	25.0	27.8	30.6	33.4	36.1	38.9	41.6
3	25.0	29.1	33.3	37.5	41.7	45.9	50.1	54.2	58.3	62.4
4	33.3	38.8	44.4	50.0	55.6	61.2	66.8	72.2	77.8	83.2
5	41.67	48.5	55.5	62.5	69.5	76.5	83.4	90.25	97.2	104.0
6	50.0	58.2	66.6	75.0	83.4	91.8	100.1	108.4	116.6	124.8
7	58.3	67.9	77.7	87.5	97.3	107.1	116.9	126.4	136.1	145.6
8	66.6	77.6	88.8	100.0	111.2	122.4	133.6	144.4	155.6	166.4
9	75.0	87.3	99.9	112.5	125.1	137.7	150.2	162.5	174.9	187.2
10	83.3	97.0	111.1	125.0	138.9	152.8	166.7	180.5	194.4	208.3

high torque, compensating this effect by decreasing propeller diameter still results in a propeller which is ultimately operating at a fairly high angle of attack under flying conditions. Control line models are an exception to this rule where flying speeds are usually much higher but the average free flight duration model usually benefits from the use of a low pitch propeller with a pitch: diameter ratio of approximately 0.3 as this still allows a reasonable diameter to be employed and permits the engine to obtain a high operating r.p.m. consistent with an approach to the peak of its power curve.

It is strongly recommended, however, that more attention be given to selection of propeller size with regard to the operating r.p.m. achieved with any particular engine. Apart from the baby engines virtually restricted to one standard "stock" size, maximum performance from any engine means a propeller size which will give a static r.p.m. of the order of 80%, or possibly slightly greater of the r.p.m. corresponding to maximum B.H.P.—as given by a performance curve for that engine.

For sports flying lower operating r.p.m. can be used, i.e., larger propeller sizes, to reduce both engine wear and fuel consumption (as well as eliminating the "kick" often experienced when starting a fast engine with a small propeller). Many sports type engines do, on fact, develop peak power at appreciably lower r.p.m. than their racing counterparts when they should again be operated at a similar static r.p.m. figure (e.g., 80% maximum). A racing engine, which "peaks" at 14 to 15,000 r.p.m. (static) could well be held down to around two-thirds of this figure for sport flying. Fig. 7.



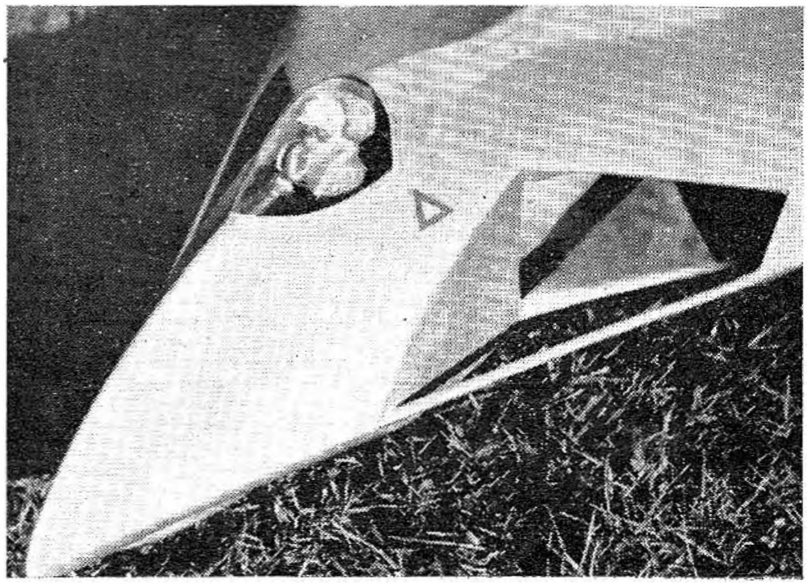
The author posed with one of his latest models XD 50, which had its maiden flight in April, 1954, and is illustrated on page 93.

FLIGHT TESTING AND DEVELOPMENT OF MODEL JET UNITS AND AIRCRAFT

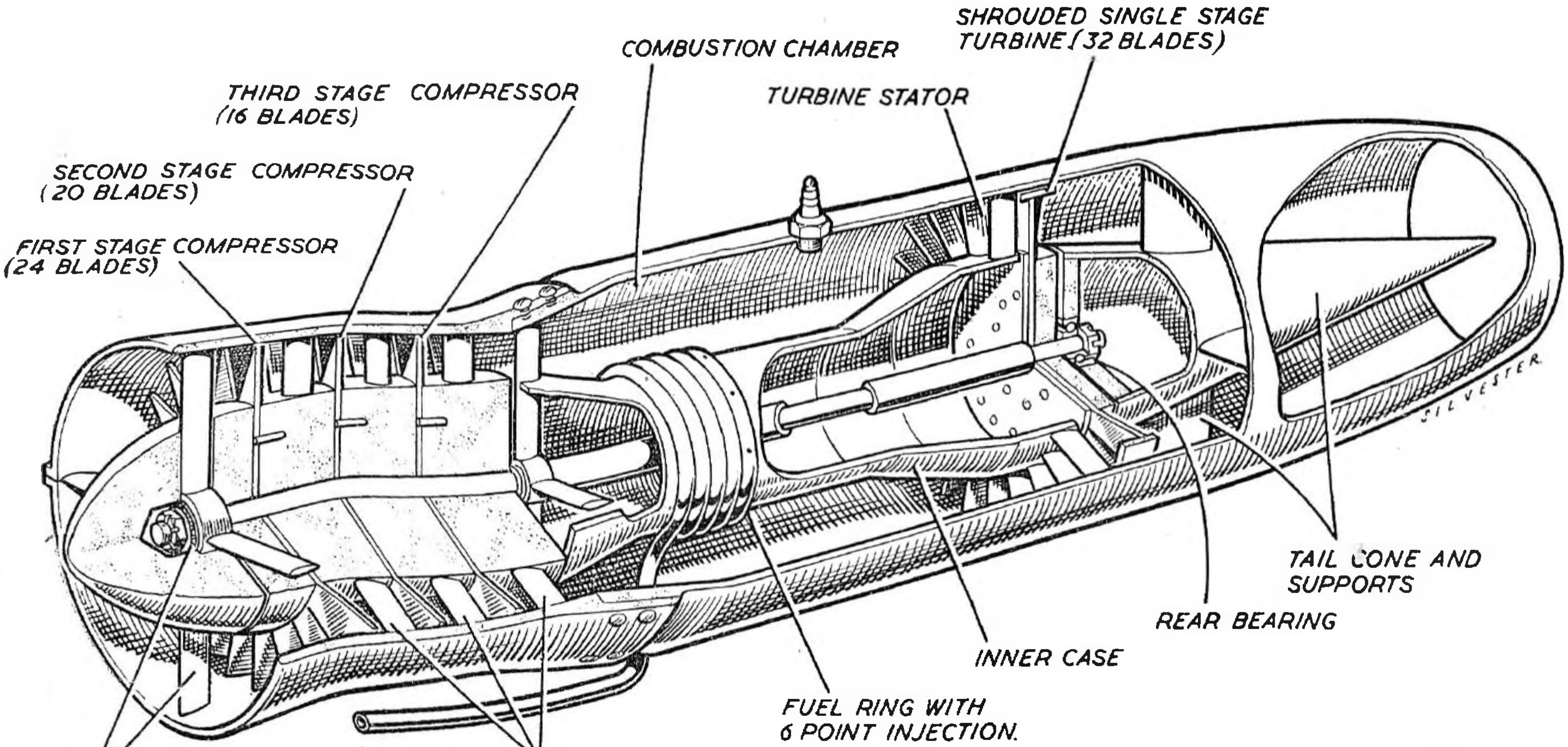
By W. BALL

SPACE DOES not allow me to cover anywhere near the complete course of events and experiments that I have carried out since my first rocket powered model flew in the summer of 1942, this solid balsa flying wing powered by a Brocks 6d. "fire trail" caused quite a commotion and instant intervention of the Law, but I hope to convey some of my results in as simple language as possible to the model world. I have not gone into details of thrust measuring, etc., as anyone interested enough to build one of my units will have enough knowledge about that already, and the not-so-informed model bod will follow the article better. Delta designs which can be built as gliders are marked "G" and I hope that if anybody builds one they have as many happy hours as I have had in flying them.

The development of Delta Aircraft soon envolved entirely new wing sections, C.G. positions, etc., in fact, all the old formulae soon faded out, and, out of some 50 design studies during the past 10 years, I have built nine larger type R/C aircraft and a number of one-third size

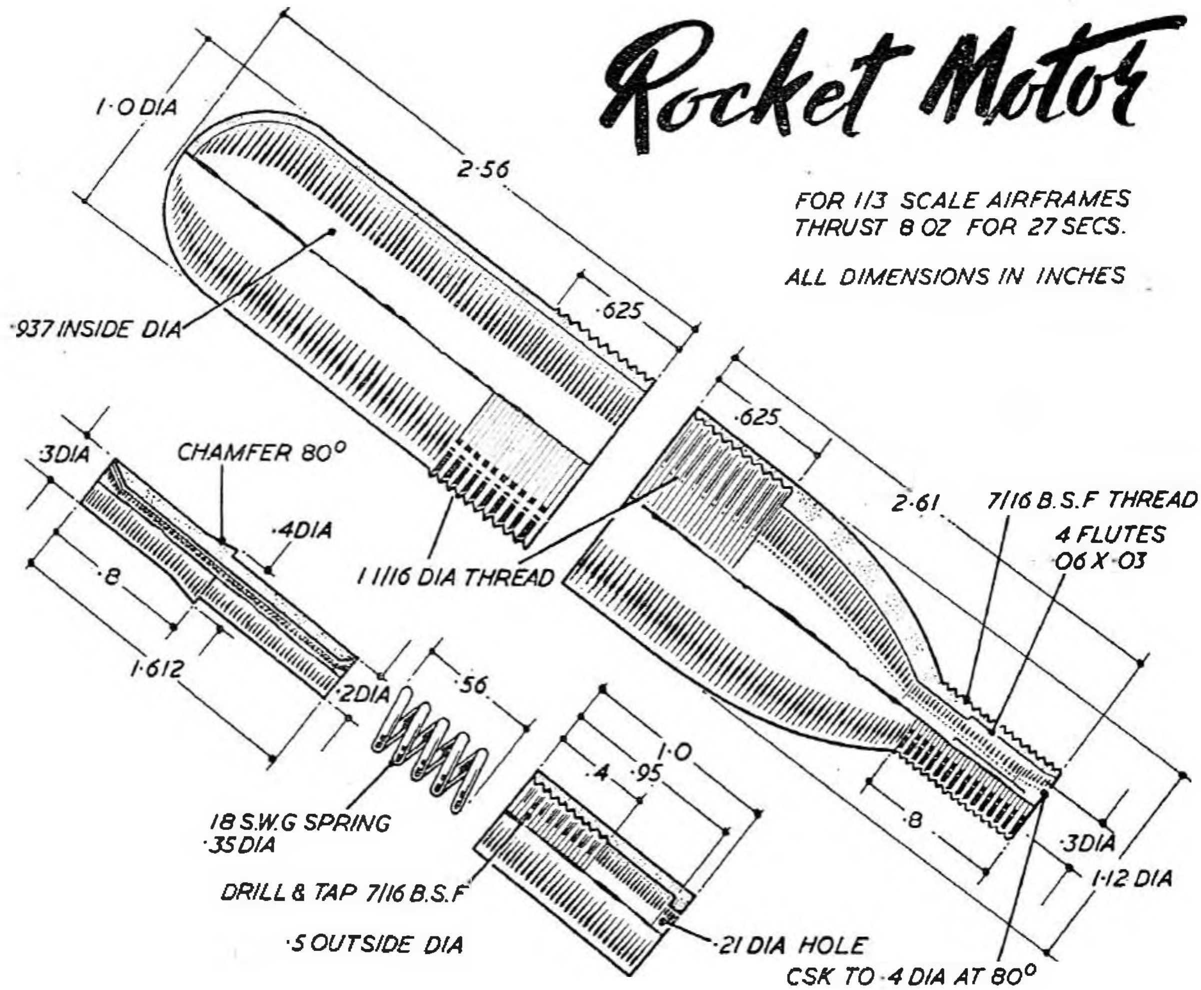


A close-up of the pilot's cockpit in X-D-50, detail which adds much to the veracity of these ambitious projects.



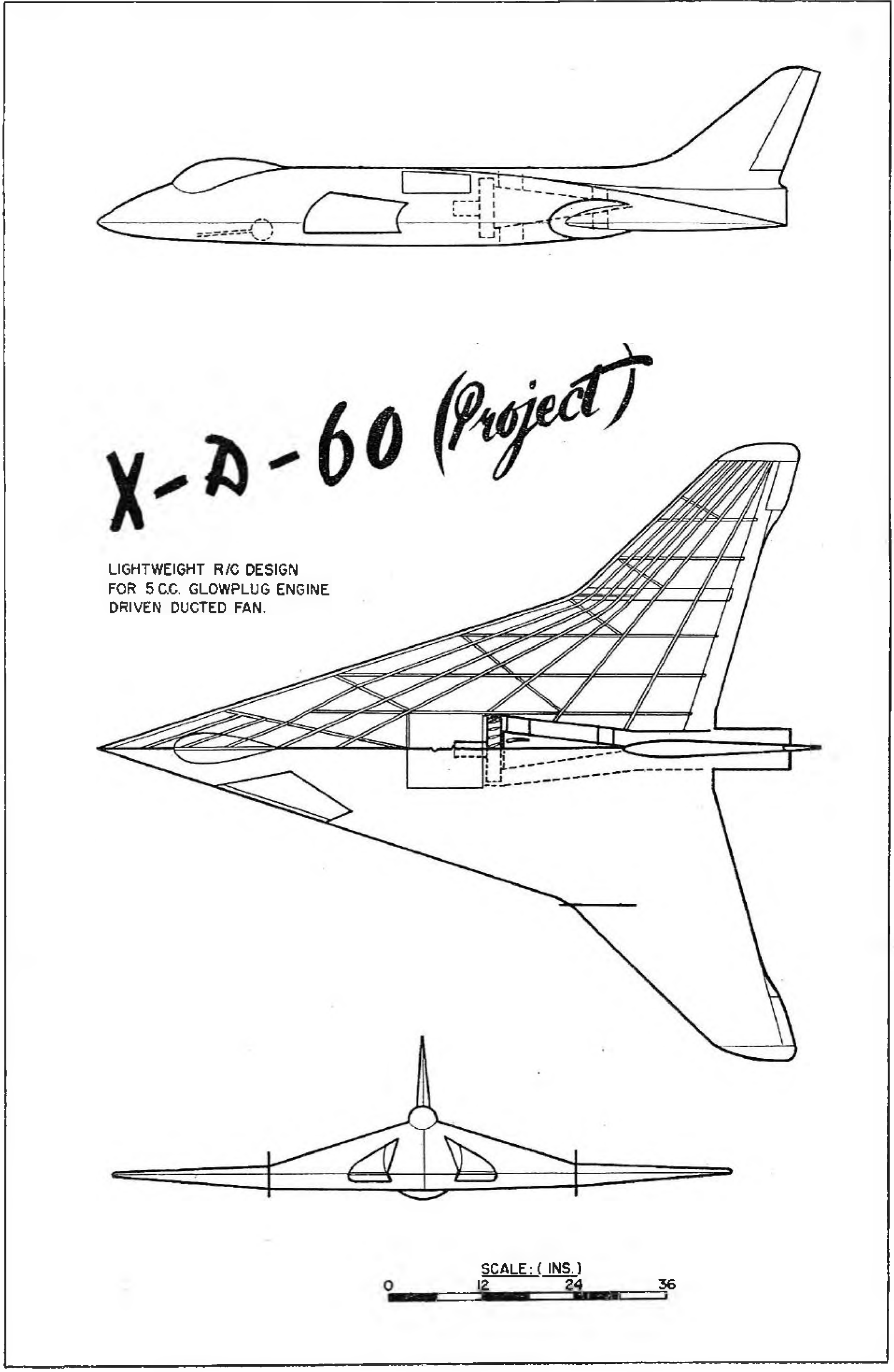
BALL X-J-E/20 MODEL TURBINE

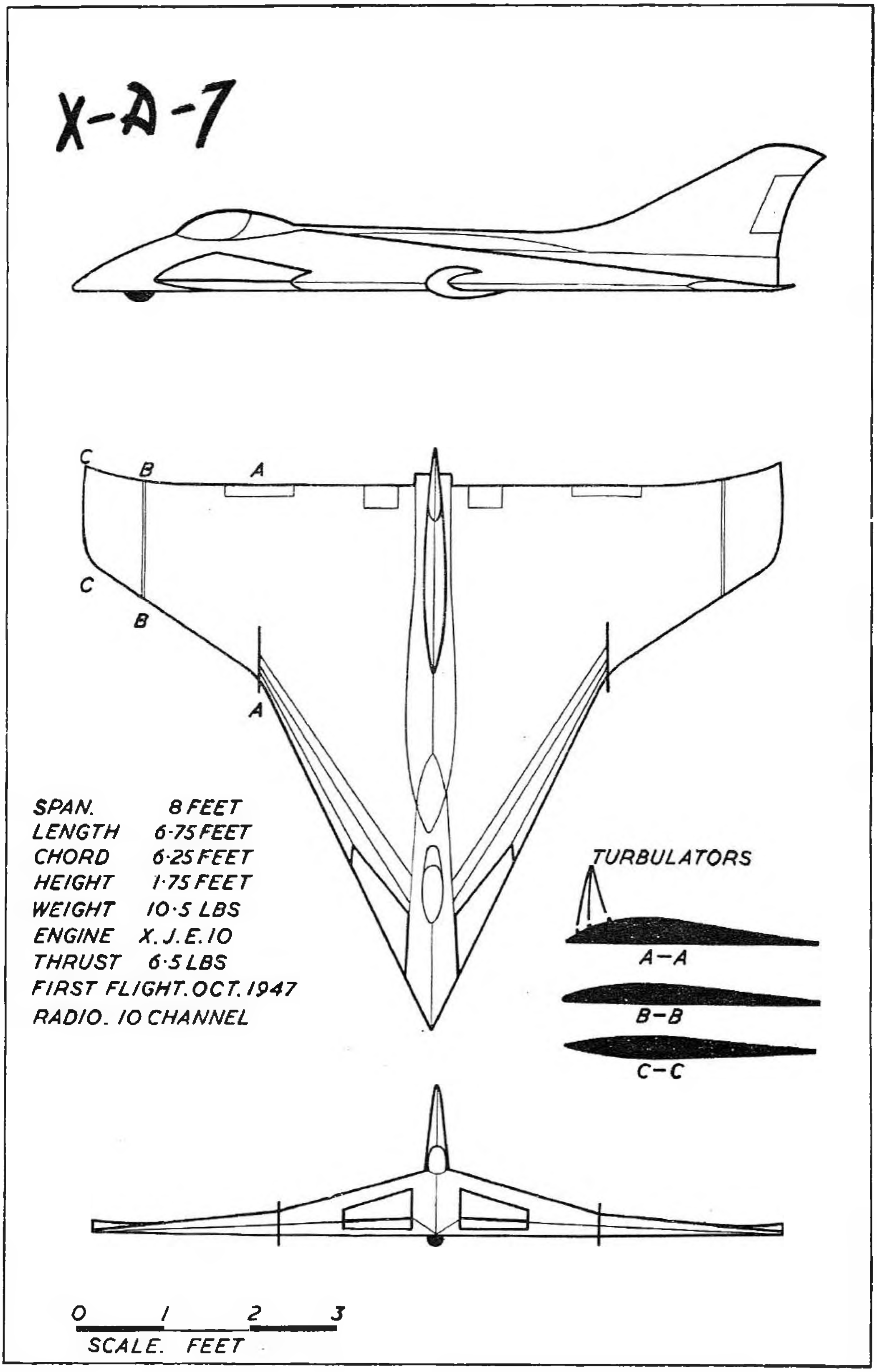
LENGTH	2 FT. 4 IN.
DIAMETER (MAX)	6·5 IN.
WEIGHT	3 LBS.
STATIC THRUST AT 26000 R.P.M. (MAX)	10·8 LBS.

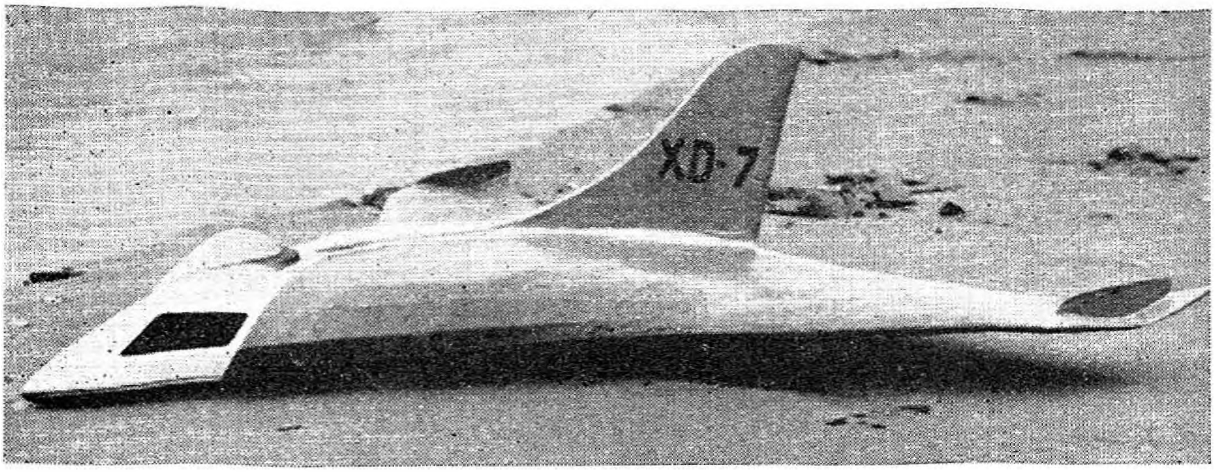


prototype models as well as part sections for wind tunnel tests. Instead of names I evolved a letter-number code, which was easier to find in the ref. books I compiled from each aircraft and experiment, X-D-7 meant to me X experimental, D Delta, 7 the seventh design of that type, the same applied to my engines, X experimental, J Jet, E engine, No. the design number, not engines built.

A few days after V.E. Day, May 14th to be exact, peaceful farm workers gazed worriedly across to "Them Londoner's" humble abode on the lonely Lincolnshire coast, a howling, whistly, roar was emitting from one of the out-sheds. If they had seen inside at that momentous occasion, they would have observed a wild war dance being performed by two grinning people, father and son, and a workbench slowly sliding across a concrete floor, due to the fact that a tube mounted on same was emitting a 2 ft. flame and black clouds of smoke, it was our first successful running of a turbo-jet. My first interest in liquid jets was aroused when I examined an unexploded Doodle-bug, and with my father's help, I built a Pulse unit. It was a heavy and erratic, but it did work. From then on we developed quite a number of units and moving to the lonely East Coast gave us unrestricted flying facilities. I then learnt more about Jets at De-Havilland Tech. school, examined section Goblins and watched bench tests when I next went home to recover from an accident. I had a number of designs worked out for a model turbo-unit, that, unlike previous models, would work. As recorded, it did, and from then on I carried out extensive experiments. Dad was left behind on jets, but held his own in designing the Radio Control


X-D-60 (Project)
LIGHTWEIGHT R/C DESIGN
FOR 5 C.C. GLOWPLUG ENGINE
DRIVEN DUCTED FAN.
SCALE: (INS.)
0
12
24
36

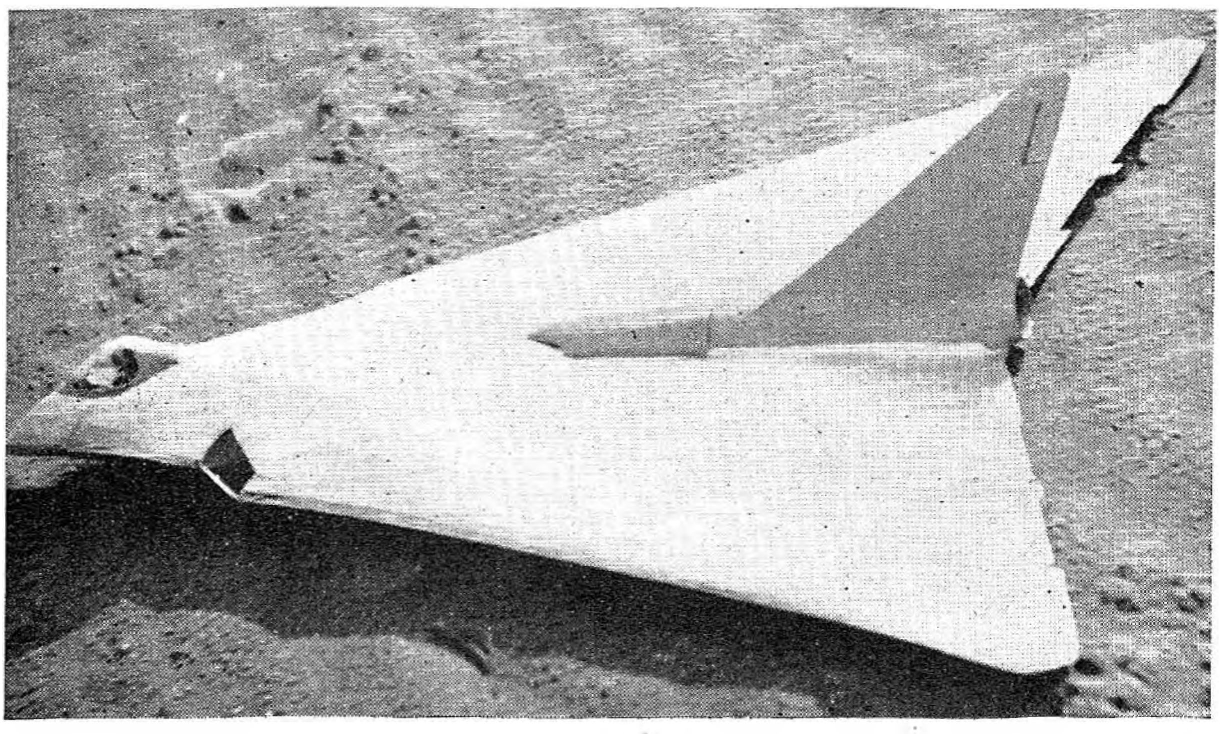

X-D-7
C
B
A
C
B
A
SPAN. 8 FEET
LENGTH 6·75 FEET
CHORD 6·25 FEET
HEIGHT 1·75 FEET
WEIGHT 10·5 LBS
ENGINE X.J.E.10
THRUST 6·5 LBS
FIRST FLIGHT. OCT. 1947
RADIO. 10 CHANNEL
TURBULATORS
A—A
B—B
C—C
0 1 2 3
SCALE. FEET

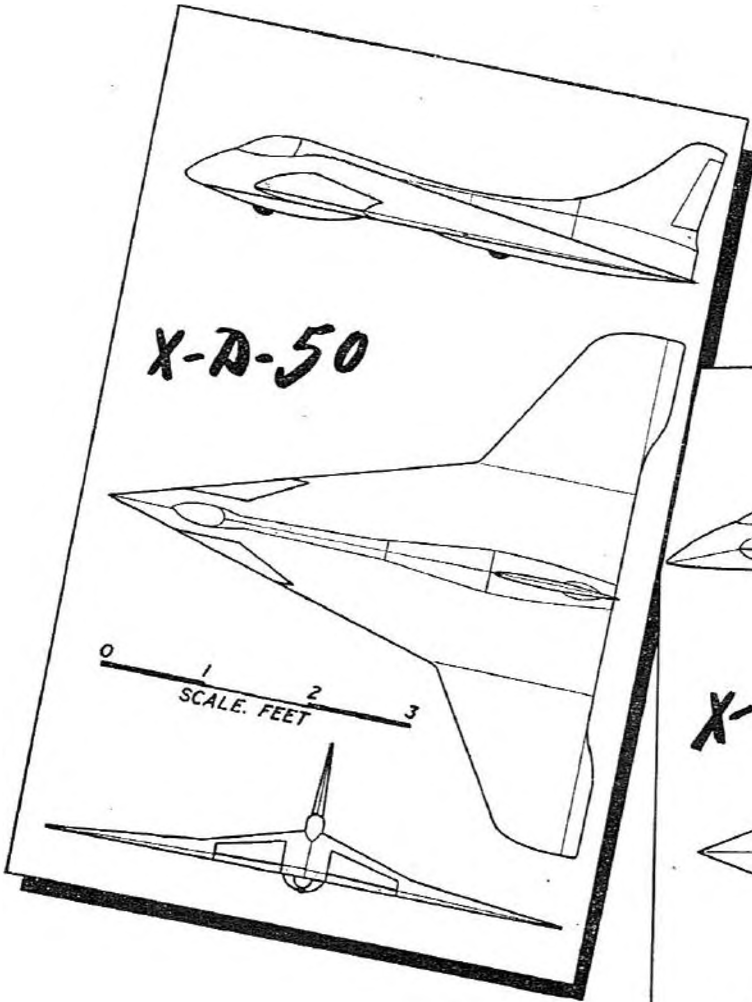


An earlier model X-D-7, which first flew in October, 1947, and was equipped with ten-channel radio-control equipment.

equipment for the models. At the closing of the war, I had seen some German design studies and was impressed by the Lippisch design for a Delta interceptor. I designed and built one basically similar which flew very well under pulse jet power and single channel radio. Exceptional behaviour around the stall (which was practically non-existent) impressed me considerably. The next design had no fuselage, being a pure wing with double sweep on the leading edge and variable incidence wing tips. This was built in the light of experience gained from several $\frac{1}{3}$-size models powered by solid fuel rocket motors and after just over a year it was completed. I first flew it powered by two diesels each driving a 2-stage compressor (now called ducted fans). After getting all the trim's stalling speeds, etc., I fitted the turbo-unit which had been exhaustively tested on the bench for nearly eight months, and on a calm frosty morning in October, 1947, the X-D-7 took off the vast beach to remain airborne $8\frac{1}{2}$ mins.,

X-D-20, first tested in July, 1948, and the subject of three one-third size prototypes, and a final full-size radio-controlled version. (Illustrated on page 93).

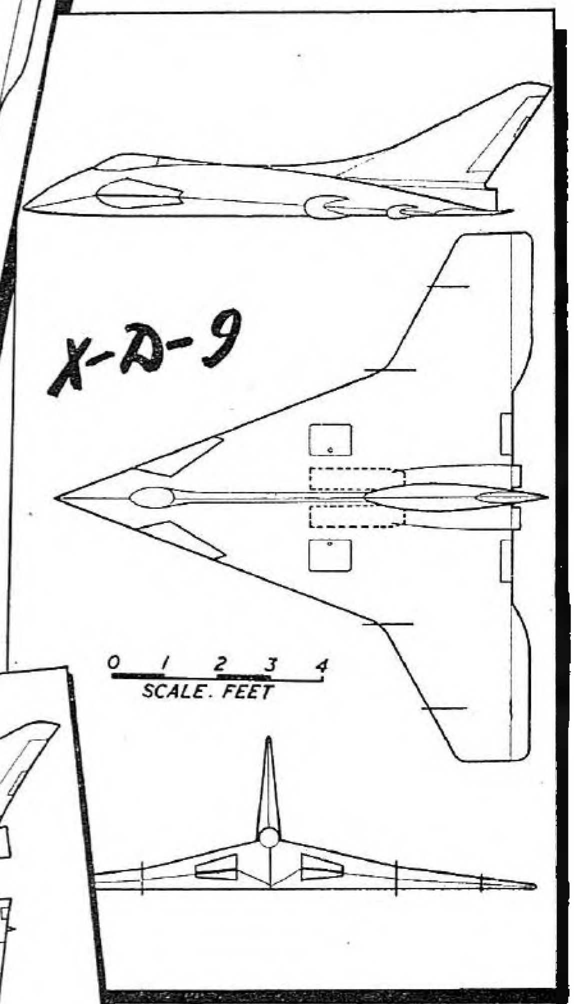


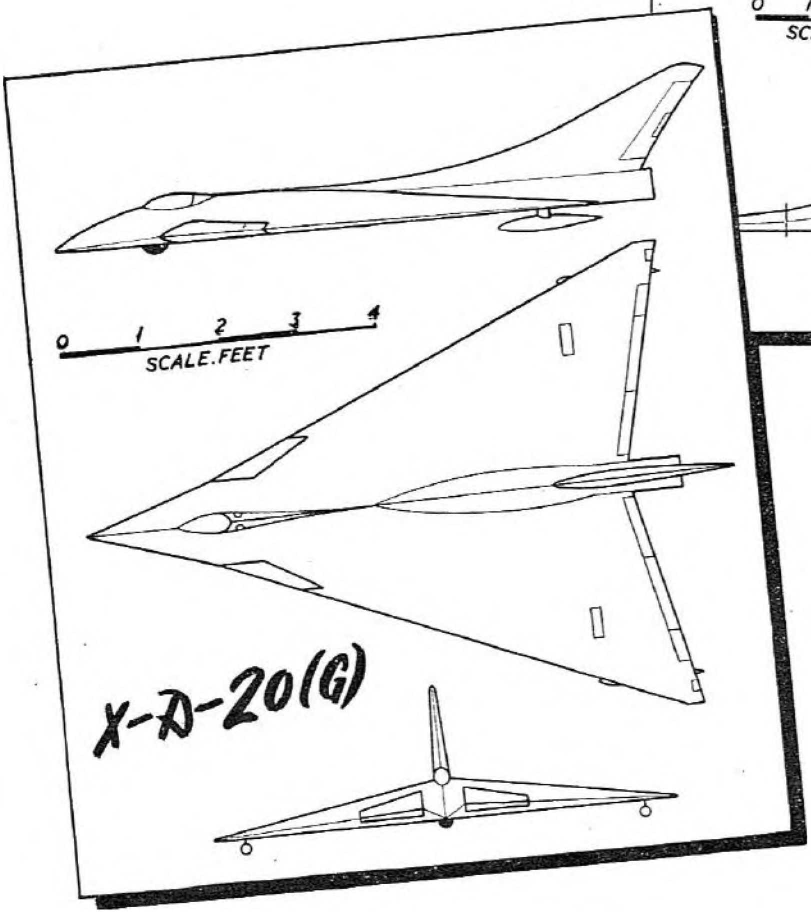


X. D. 50

SPAN	5·0 FEET		
LENGTH	9·5 FEET		
CHORD	4·95 FEET		
HEIGHT	1·45 FEET		
WEIGHT	4 LBS		
ENGINE	X.C.U 8 OR	X.J.E 30 OR	X.P.J 15
THRUST	2 LBS	6 LBS	5 LBS

FIRST FLIGHT. APRIL. 1954





X. D. 9

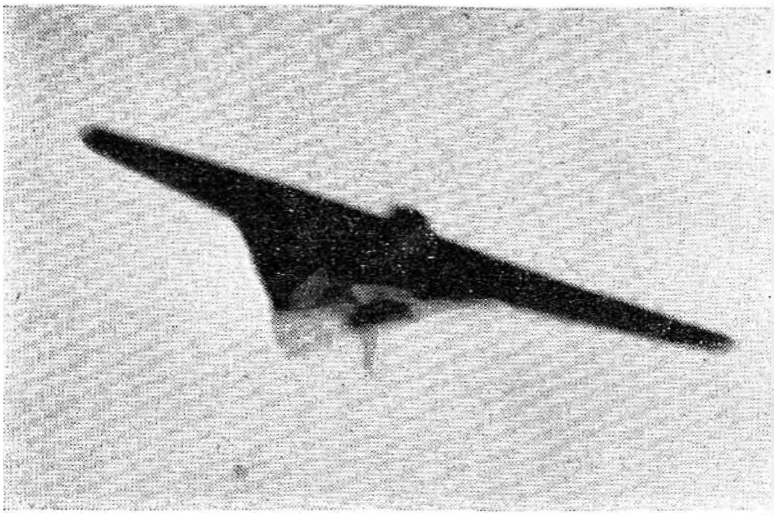
SPAN	10 FEET
LENGTH	9·5 FEET
CHORD	8·75 FEET
HEIGHT	2·55 FEET
WEIGHT	12·5 LBS.
ENGINES	X.J.E 14 (TWO)
THRUST	17 LBS (TOTAL)

FIRST FLIGHT. MARCH. 1950

X. D. 20(G)

SPAN	6·0 FEET
LENGTH	8·25 FEET
CHORD	6·55 FEET
HEIGHT	1·55 FEET
WEIGHT	10 LBS
ENGINE	X.J.E 20
THRUST.	10·8 LBS

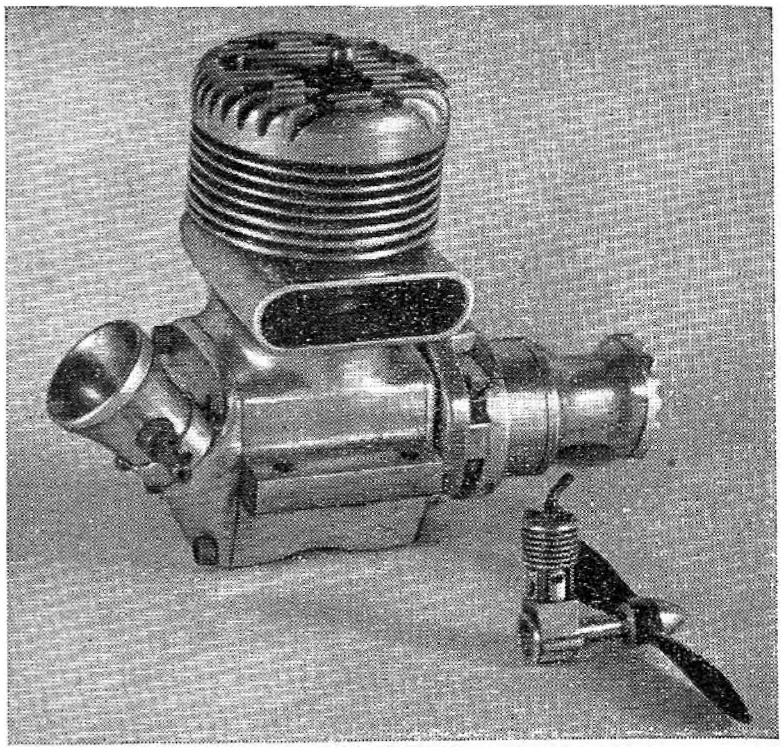
FIRST FLIGHT. JULY 1948



In spite of their large size—for models—these deltas fly so fast that action pictures are difficult. However, flying shots of a number of marks have been submitted to us, and this very much enlarged picture shows X-D-50 on speed test.

the rudder worked perfectly although the actuator was mounted in the fin above the jet pipe. The span was 8 ft., chord 8 ft. 6 in., weight with radio $10\frac{1}{4}$ lbs. The motor operated wing-tips gave excellent trim controls combined with the 3-speed engine, it enabled high-speed level flight to be obtained and a nose high float after fuel had run out. The engine the X-J-E-10 had a 4-stage axial compressor, annular combustion chamber and single stage turbine. As the root rib depth was 1 ft., there was ample room for heat insulation and air cooling. After much practice at handling the X-D-7, high-speed runs were commenced, some local sports timekeepers being lured to the beach for the purpose of stop-watching. The plan was, one timekeeper with Dad and I at the transmitter and another a quarter mile downwind, this gave approximately a quarter-mile run in to obtain maximum speed and a quarter-mile in which to clock the run. Speeds of well over 100 m.p.h. were obtained, but when I wrote to *Aeromodeller* at the time, they were horrified to think I was flying Free Flight Jets, which had apparently been banned, and informed me I deserved two years hard labour at least. This naturally discouraged any further communication from me! A number of Delta's and flying wings, rocket missiles and stub winged rocket planes launched from a large radio model of orthodox layout followed during the following years, and various jet engines were developed, pulse, turbo and ram. Also a diesel driven compressor with fuel injected into the tube proved very successful, and cut out many tedious hours building a turbine. Then at 8.20 Sat., Jan. 31st, '53, came tragedy in the form of 10 ft. of swirling sea water, and a heap of rubble for a model shed. I lost nothing compared with some people that night, but I did lose the results of 10 years work. The East Coast Floods however have not stopped me altogether. I have recently finished a ducted fan powered Delta, a lightweight version of an earlier model, it is for ordinary three-channel radio, weighs 4 lb. all up and can be easily converted to a jet unit for power if required, at the moment I am carrying out some low-speed tests from 5-40 m.p.h. I have left out all the fire's, exploding units, singed hair and bandaged hands, and one burnt out workshed that occured during the course of development of these Jet units. and Solid Fuel Rocket motors, the accompanying scale drawings are all well proven designs and anyone interested in building any of them will have a model that has done many hours Flight testing, and providing it is built accurately, will be quite efficient. As to the radio, it's a mystery to me, I leave that to Dad, and he leaves me to the Jets, I don't know why?

FUELS & FORMULAE



They come in all sizes! These two engines, both constructed by S. N. Bibby of Wavertree M.F.C., represent top and bottom limits at 10 c.c. and .05 c.c. capacity. The smaller engine was made on a 2 in. centre homebuilt lathe. There are larger engines but we doubt if there are many smaller!

THERE are basically two types of fuels used in model engines—those which fire under the heat of compression alone (diesel fuels), and those fired by a spark or hot wire (spark-ignition or glow motors). The requirements of the two fuels are conflicting in many respects, hence it is most convenient to consider them under separate headings.

DIESEL FUELS

A basic diesel fuel normally consists of three separate solutions, intimately mixed. One of these is invariably diesel oil, paraffin or gas oil, which supplies the bulk of the energy of the fuel when burnt. None of these oils possess particularly good lubricating properties, however, and so a generous proportion of a lubricating oil, either vegetable or mineral base must also be incorporated.

The self-ignition temperature of the mixture is still too high to fire under the temperatures realised in model diesel practice and so a further constituent is necessary which has a low self-ignition temperature. This is invariably one of the ethers, normally ethyl ether. A satisfactory basic diesel fuel can then be produced by mixing these three constituents in equal proportions:

1 part paraffin, commercial diesel oil or high cetane gas oil;
1 part castor oil or SAE 40 mineral oil;
1 part ethyl ether.

Regarding the first constituent, paraffin has a higher calorific value than diesel oil, implying that for equivalent power, fuel consumption must be slightly higher with a diesel oil mixture. However, this is offset by the fact that diesel oil does possess some lubricating properties and hence the proportion of lubricant in the mixture can be reduced slightly.

The type of lubricant is not particularly important. Modern mineral oils have properties equivalent to castor (vegetable) oil. Castor will not mix with a paraffinic oil alone, but will blend readily in the presence of ether. Hence the use of castor lubricant is confined to ready-mixed fuels. The *quality* of castor used is important. Pure castor oil is to be preferred to castor blends which may tend to form precipitates on standing due to the presence of additives. Some commercial diesel fuels contain both a mineral oil and castor. Others incorporate colloidal graphite, which has outstanding lubricating properties.

Apart from its low self-ignition temperature, and very wide explosive limits making it not critical as regards mixture strength for firing, ether is not particularly desirable in a diesel fuel. It *has* to be employed for starting purposes. However, it detonates readily which means that an excess of ether is to be avoided since it produces a "harsh" fuel which tends to knock and increase the loads on the connecting rod of the engine. Ideally a good diesel fuel should contain the minimum proportion of ether necessary for easy starting and no more. Stale fuels may often be "pepped up" by the addition of a little ether (to replace ether lost by evaporation), but the proportion of ether contained in fresh commercial fuels is usually slightly higher than necessary to provide a "safety margin" for starting and so should not be increased. Fuels which have to be mixed by adding ether should not have *more* than the recommended proportion of ether mixed with them.

Commercial ether is available under a variety of names. Ethyl ether, the common ether used in most model fuels, is sold as Ether .720, Ether B.S.S. 759, Sulphuric Ether and Ether Meth. Any is suitable. Sulphuric Ether contains no acid. The reference is simply to the method of manufacture. Ether Meth. is made from methylated spirits instead of pure ethyl alcohol.

Various dopes of additives are often added to model diesel fuels to give enhanced properties. Strictly speaking the addition of a "dope" is designed specifically to reduce the delay between raising the diesel mixture to its self-ignition temperature and the occurrence of the actual explosion—known as the Ignition Lag. This promotes smoother running.

Only quite small proportions of "dope" are needed to produce this effect. More "dope," in fact, can have undesirable, and even harmful, effects. Seldom does the added proportion of dope exceed 3 per cent., and it is usually much less.

Numerous chemicals are suitable for this purpose, but current practice is confined to the use of two—amyl nitrite and amyl nitrate. The latter is more positive in effect, but rather difficult to obtain locally. In practical terms, a good "dope" can be considered as an artificial compression raiser. A correctly doped diesel fuel will usually run, very smoothly, at a lower compression setting than an undoped fuel of similar proportions. With an excess of "dope" it may even be necessary to slacken off the compression appreciably as the engine warms up. Most commercial diesel fuels contain a small proportion of dope (usually amyl nitrite) to promote smoother running.

In formulating a high-performance diesel fuel it is an advantage to increase the proportion of the paraffinic base at the expense of the lubricating oil constituent, on the basis that the latter is present in excess anyway and merely increases fuel consumption with no increase in power once there is *sufficient* lubricant present. With any good mineral oil or castor, or a mixture of both, a 20 per cent. lubricant proportion would appear more than adequate. Ether content can remain about the same, or slightly reduced for preference, when the fuel formula becomes:

Paraffin, diesel oil or gas oil ...	50 per cent.
SAE 40 (or castor)	20 per cent.
Ether	30 per cent.

To this should be added $2\frac{1}{2}$ per cent. (maximum) amyl nitrate to promote smooth running.

SPARK-IGNITION FUELS

A majority of spark-ignition fuels are based around a simple petrol-oil mixture, usually in the ratio of 3 or 4 to 1. These are non-critical, economic fuels for use in all spark-ignition engines with a moderate or low compression ratio.

For higher compression ratios a plain petrol-oil mixture may tend to "knock" or "pink." Rather than employ an anti-knock additive like tetra-ethyl lead, the addition of 10 per cent. benzene raises the octane value of the fuel to a satisfactory level. Alternatively, an alcohol fuel can be employed. The most common alcohol used is methanol, mixed with castor oil as the lubricant. Methanol has a lower calorific value than petrol and so requires a more open needle valve setting, *i.e.*, fuel consumption is higher. Methanol fuels, however, are almost invariably employed in high compression spark-ignition engines. The calorific value may be raised (and thus fuel consumption lowered) by the addition of a ketone, such as acetone. Typical spark-ignition fuel formulae then are:

For low compression engines:

Petrol: SAE 40 oil 3 or 4 : 1.

For medium compression engines:

As above plus 10-15 per cent. benzene.

For high compression engines:

Methanol:castor 3 : 1 (plus up to 10 per cent. acetone).

GLOW-MOTOR FUELS

Both petrol and methanol (alcohol) fuels give satisfactory performances in glow-plug engines. Alcohol fuels, however, are generally to be preferred, particularly as most glow-plug motors are designed with a medium to high compression ratio. Fuel mixture is far from critical and, provided there is *enough* lubricant present, changing the proportions of alcohol : lubricant has very little effect on performance. A completely satisfactory mixture can be obtained by mixing 2 to 3 parts methanol with 1 part castor.

The quality of the methanol employed is, however, important. Methanol tends to absorb water, becoming "diluted," in effect, on exposure. Seventy-four degrees over-proof methanol contains over 99 per cent. methanol and is the recommended grade for all glow motor fuels.

The performance of both a petrol (paraffin) and methanol (alcohol) glow fuel is appreciably enhanced by the addition of a nitroparaffin. The most common forms of these additives are nitropropane and nitromethane. The former is generally used with petrol mixtures; the latter with methanol mixtures.

The addition of a nitroparaffin usually promotes easier starting and gives a better performance, *i.e.*, higher r.p.m. Starting with small amounts of added nitroparaffin, performance increases as the proportion of nitroparaffin is increased, up to a certain point. Beyond that, further addition of nitroparaffin has no marked effect.

The "ideal" minimum will vary with the type of engine concerned and may be influenced by even minor changes in design. Commercial fuels incorporating nitroparaffins usually limit the proportion of additive to about 10 per cent. partly on account of cost, and partly due to the fact that any further benefits to be gained by adding nitroparaffin in excess of this figure become increasingly less. For speed control line work, however, where fuel cost is disregarded, increasing the proportion of nitroparaffin up to a maximum of 30 per cent. may be worthwhile. A typical "racing" glow fuel may, therefore, contain 20-30 per cent. nitromethane, 25 per cent. castor and the balance 74 degrees over-proof methanol.

INEXPENSIVE MODELLING

You can spend as much as thirty-five pounds on a cabinet of aero-modelling tools. On the other hand, you need only spend a fraction of that amount on tools and equipment for a lifetime of building, turn out just as good models and probably have in your kit a number of special tools which are in constant demand and would not be included in even that elaborate set, anyway.

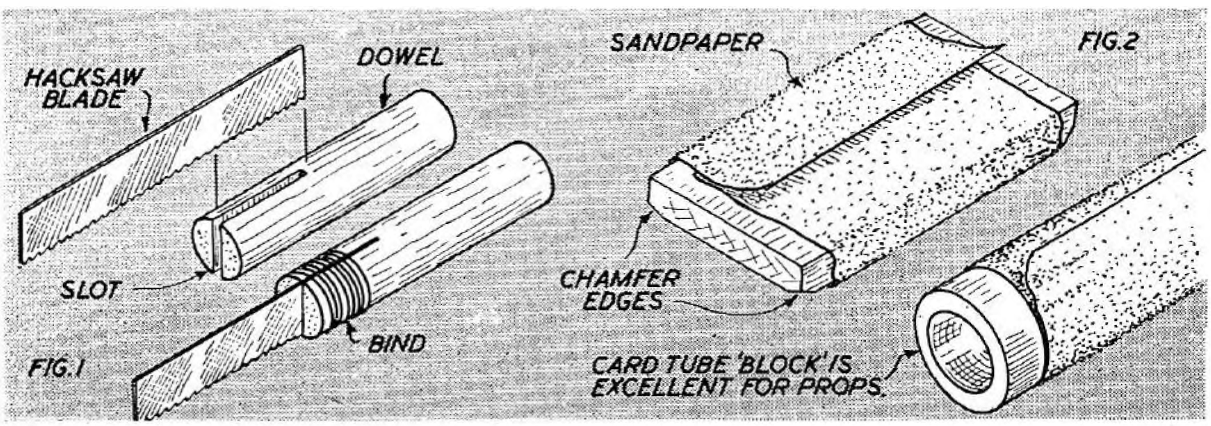
You *can* get by with a razor blade and a pair of pliers. But you will find some of the work a little tedious and accuracy not always as high as it should be. A modelling knife with interchangeable blades is a sound investment, for a start, particularly for cutting thicker sheet. From there, let us see how we can go on to build up a proper aero-modelling workshop with a minimum of expenditure.

Having purchased a modelling knife we can introduce a little economy, for a start. A whole range of blades are available for these knives—different shapes and sizes for all sorts of cutting and carving jobs. You will probably find just two blade sizes satisfactory for all your cutting needs. A razor blade will still come in handy for some of the other work where you might be tempted to "spread" yourself over a whole set of different blades.

A majority of modellers seem unaware that blades can be re-sharpened quite satisfactorily. Do not wait for them to get really blunt, but re-sharpen at regular intervals on an oilstone, or even the front doorstep, to keep them in good shape and increase their useful life many times over.

For cutting the larger sizes of balsa strip, a small handsaw is to be preferred to a modelling knife or razor blade (hard on the knife and often dangerous with a blade), both of which tend to produce a "crushing" cut if slightly blunt. Such a saw can be made from a broken hacksaw blade, as in Fig. 1. A two-and-a-half or three-inch length of $\frac{1}{4}$ or $\frac{3}{8}$ in. diameter dowel is slotted to a depth of about 1 inch, a four-inch length of hacksaw blade inserted and then bound in place with thread. This makes a handy little balsaw, easy to manipulate and with a fine cutting edge.

Sanding blocks are no harder to come by. A shop-bought article is very handy, but you can get by without one. Almost all the sanding jobs you will be called upon to do can be met by wrapping a piece of sandpaper around a spare length of $\frac{1}{4}$-in. sheet about 6 inches long, a wooden ruler or a six-inch length of mailing tube—Fig. 2. Use the large, flat block for shaping leading and trailing edges, etc., and smoothing down balsa panels. Cut the sandpaper strip slightly



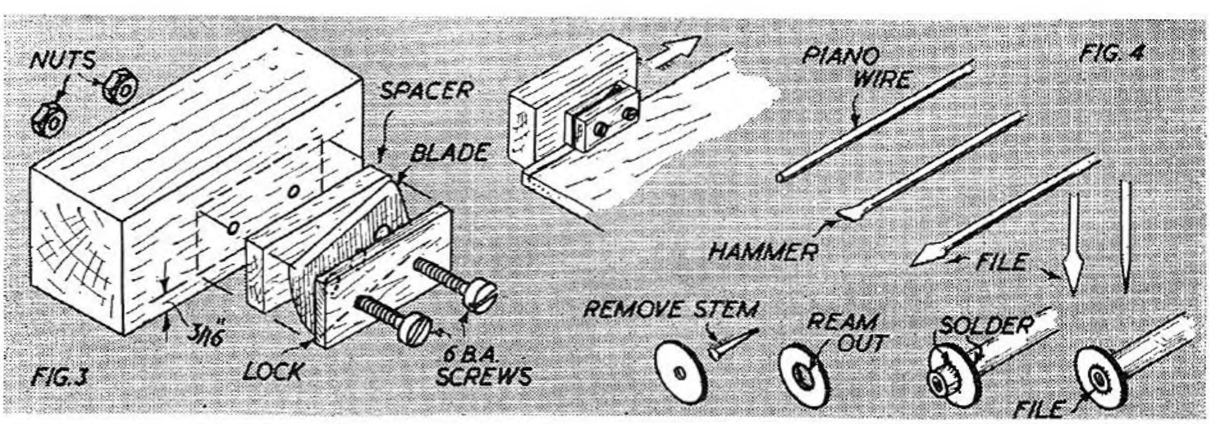
narrower than the length of the block and chamfer off the bottom corners of the block, as shown. This will prevent it "digging in." For sanding "contoured" work, as in solid model making, also for smoothing down sheet covered leading edges on built-up wings, a piece of sponge rubber as the sanding "block" has much to recommend it. Wrap the sandpaper around the rubber and grip in the usual manner. The soft backing behind the sandpaper will "give" as you work over curved surfaces. Two or three grades of sandpaper should cover all your needs—Middle 2 for rough sanding, No. 1 for cleaning up and No. 0 for finishing. For really fine finishing you might add a sheet of garnet paper.

A handy stripper for cutting strip sizes from sheet is shown in Fig. 3. This is a real economy for you can halve the cost of your balsa strip if you cut it yourself. Not only that, you can cut matched strips from the same sheet for longerons and also cut non-standard widths, if you want them. The main block of the stripper is a piece of hardwood, squared up and polished smooth. The spacers are cut from 1/16-in. ply or hardwood. Simply build up the required strip width by adjusting the number of spacers. Spacers, blade and locking piece (also of ply, or metal) are held tightly against the block by two 6 B.A. motor-mounting screws. Countersink the nuts into the far face of the block and cut off the screws so that they do not protrude unduly when assembled. To use, the stripper is located against the edge of the sheet, as shown in the smaller sketch, and then drawn along, keeping the block running smoothly against the edge all the time.

For carving large section leading and trailing edges to rough shape, prior to finishing by sandpapering, a small kitchen knife is ideal. These can be purchased for a shilling or so. Choose one with a blade about four or five inches long. Make sure that the edge is kept really sharp and keen by "stoning" regularly. You will find it handier to use than either a razor blade or a modelling knife for such jobs.

Other inexpensive items worth purchasing are one or two small files. Flat files in 1/32, 1/16, and 3/32-in. thicknesses are the ideal tools for cutting slots in leading and trailing edges to receive wing ribs, as well as for other filing jobs which may come along. A small triangular file will also be useful for cutting piano wire. A pair of cutting pliers may be more easy to use for this job, but are relatively inexpensive and not always long-lived. You can do just as neat and accurate a job with a file, scoring all around the wire and then bending to break.

Of course, buy a pair of wire cutters or cutting pliers, if you can afford them, but these need not go at the top of your list. As far as pliers are concerned, far better to invest first in a good pair of "electrician's" pliers with slender jaws. These will be handy for small wire-bending jobs. A heavier pair of flat-nose pliers will be useful for handling the tougher jobs.



A small hand-drill is another "must" for satisfactory modelling. You *can* burn holes in motor mounts with hot wire, but this is neither accurate nor good for the mounts. Since most of your drilling will be done in relatively soft materials, only an inexpensive hand-drill need be purchased. Then limit your purchase of drills to the few sizes you will normally require and build up a stock later.

Small drills, 1/16-in. diameter and under, can be made from piano wire. Cut the wire to appropriate length and hammer one end flat to a chisel shape. Then file into a diamond and sharpen—Fig. 4. Such simple drills will cut through brass and aluminium sheet just as readily as ply. For boring holes in ply and similar materials a cobbler's awl is just as good as a drill, and easier to use.

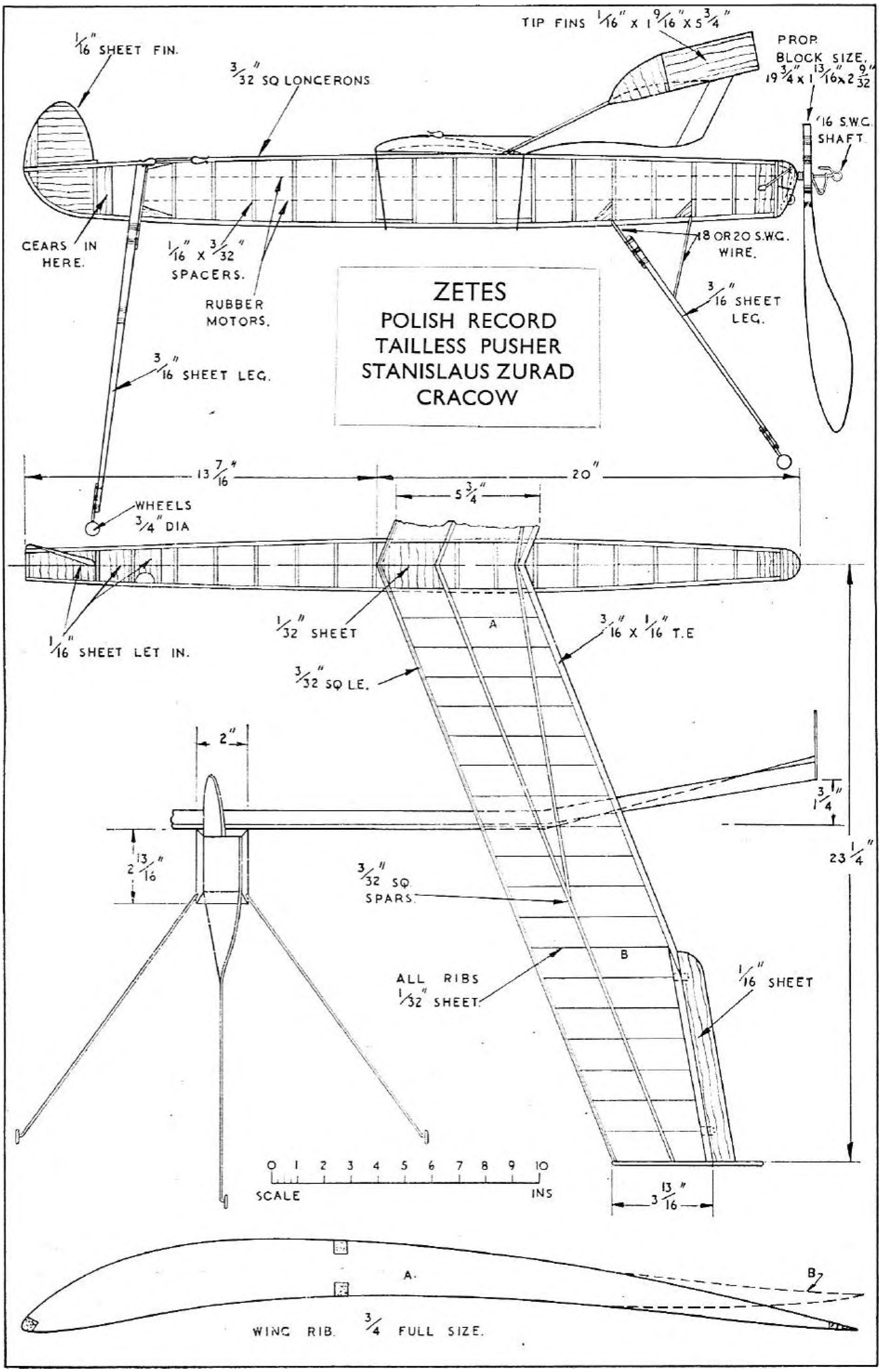
For metal-working jobs, including satisfactory wire bending, you will really need a small vice. Again this is one of those pieces of workshop equipment worth saving up for. If you have no workbench to which you can bolt down the vice, attach it to a base of stout wood about a foot square, longer if possible. This will form a sort of portable workbench which can be laid on the table when you want to use the vice. Alternatively, purchase the type of vice which can be clamped to the edge of a table.

Do not be afraid of tackling simple metal-working jobs, even if you are only a "razor-blade carpenter." You can often make up small fittings to save yourself money. Nose bushes, for example, are easily made from a short length of brass tubing of the right bore and two drawing pins. Break off the stems of the drawing pins and knock clear of the head. Open up the hole in the head by "reaming" with the tang of a file until it is large enough to slip over the tube. Solder on one end fitting. Then solder the second drawing pin "washer" in place after mounting the bush.—Fig. 4. For soldering, a shilling iron (from Woolworths again) heated on the gas stove is probably better for the job than an expensive electric iron. The latter, however, is a "must" for soldering up electrical connections, *e.g.*, in radio control modelling.

The largest item of equipment—and possibly the most important—we have not yet mentioned. That is the building board. A good building board is really vital for good construction. A large drawing board is excellent, if you can afford one. Failing that, any board or built-up panel which is flat, smooth and free from warps can be used. The trouble with a "ready-made" building board like a cupboard shelf, etc., is that the wood is often too hard to enable pins to be pushed in easily.

A very satisfactory building board with a "soft" surface can be made from a panel of plasterboard or "softboard." This costs about three shillings per sq. yd. for a thickness of 5/8-inch. A piece 3 ft. long and 2 ft. wide should be satisfactory for small and medium size models—larger if you anticipate building longer models. The surface of this board will not be as smooth or durable as you could wish for, but it will only cost a few shillings to cover it complete with balsa sheet, stuck down with an inexpensive glue. Weight down to dry flat and then smooth off with sandpaper. You should then have a very satisfactory building surface, especially if you have selected medium hard sheets for covering.

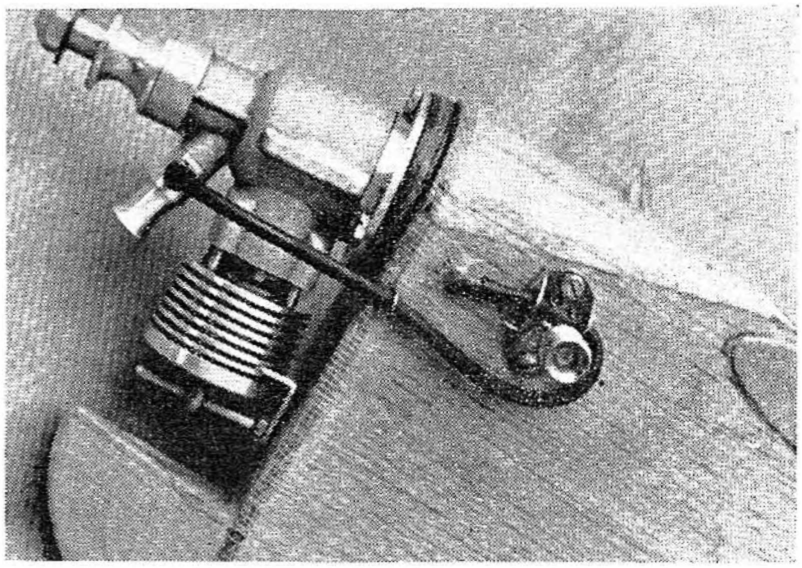
Finally, just another small economy you might care to practise. When applying dopes with a brush, fill the lid of the dope bottle with thinners when you have finished the job. Clean out the brush in these thinners and then pour back into the bottle. This will "top up" the dope and make it last longer—and also ensure that your dope brush is ready for use next time.


TIP FINS 1/16" x 1 9/16" x 5 3/4"
PROP BLOCK SIZE. 19 3/4" x 1 13/16" x 2 9/32"
1/16" SHEET FIN.
3/32 SQ LONGERONS
1/16 S.W.G. SHAFT
GEARS IN HERE.
1/16" x 3/32" SPACERS.
RUBBER MOTORS.
18 OR 20 S.W.G. WIRE.
3/16" SHEET LEG.
ZETES
POLISH RECORD
TAILLESS PUSHER
STANISLAUS ZURAD
CRACOW
3/16" SHEET LEG.
13 7/16"
20"
5 3/4"
WHEELS 3/4" DIA
1/32" SHEET
A
3/16" x 1/16" T.E
1/16" SHEET LET IN.
3/32" SQ LE.
2"
3/4"
1 1/4"
2 13/16"
3/32" SQ. SPARS.
23 1/4"
B
1/16" SHEET
ALL RIBS 1/32" SHEET.
0 1 2 3 4 5 6 7 8 9 10
SCALE INS
3 13/16"
A.
B
WING RIB. 3/4 FULL SIZE.

TIMER SURVEY

By

RON MOULTON



WHY, AND HOW WELL A TIMER CAN BE EXPECTED TO WORK IS DETAILED IN THIS REVIEW OF AVAILABLE EXAMPLES

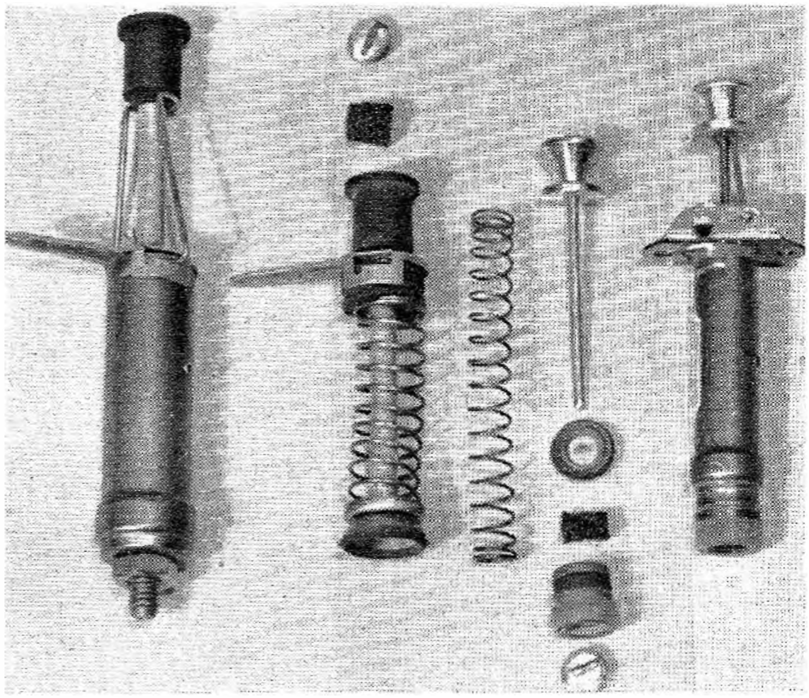
"OVER-RUN"—what word could be more unpleasant for a power modeller to hear from the man with the stop watch at any contest. I remember so many occasions when maximum flights have been disqualified as "attempts" due to an overlong run, and among them are Ray Monks and George Upson's flights in the '52 and '53 World Power Championships, and George Fuller's fated flights in the '54 Team Eliminators. Now these modellers are in the top table of power flying, each has represented his country and each is sufficiently established in the hobby to be able to make his choice of timer from any of those available in Britain or the U.S.A.—why, then, should they of all people suffer from "Timeritis," the symptoms of which are known to all who have entered a free-flight power event?

Nor is this disease limited to British modellers, for at the Cranfield contests in '53 I recall that Dave Kneeland complained bitterly of the irregularities of his airdraulic timer which cut seconds off his possible power run, and caused him to state: "What power modelling needs most in this world is a good and reliable timer, capable of being set to a second and good enough to remain set for ever." From a World Champion, this is a significant statement and we could not do anything but agree, and, so I learn from one who should know, the timer manufacturers also feel the same way.

A timer is a mechanical item solely devised to stop a motor at a previously determined time period. It can operate pneumatically (a system more widely known as "airdraulic") by clockwork, or by fuel limitation. Its purpose is to limit the motor run to the maximum period permitted for the contest, and this can be anywhere between 10 and 15 seconds. The critical factor is that it should stop the motor precisely at the last second of the maximum time allowed, and any variation over or under can be classified as unreliable, even though the fluctuation may be as little as one whole second. In that single second a fast climbing power model could gain as much as 40 feet of altitude and to lose that much from the climb could also mean a sacrifice of 25 seconds or more in the total glide duration.

To make a timer capable of operating a fuel shut-off valve to the standards of precision required for aeromodelling, and yet able to come within the bounds of reasonable weight limits is a problem of manufacture that few engineers appear willing to tackle. Fortunately, we in Great Britain are kept in good supply

Internals of the two popular diesel type timers produced by Elmic, reveal the plunger and valve construction. *At left*, the diesel timer is withdrawn, and next to it is shown the plunger or "stem" with spring relaxed. Square of sponge rubber and grub screw form a valve in the stem head. Smaller diameter spring is for the Mini-diesel timer at right, which incorporates a body-valve in the base again using the Elmes sponge rubber valve system. Diagrammatic action sketches are overleaf.



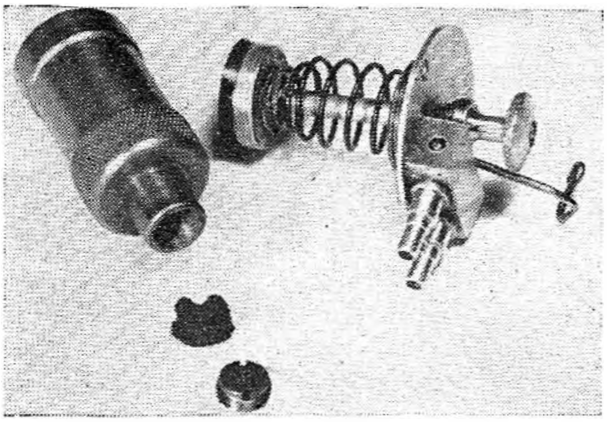
by two principal companies. In the U.S.A., where the modelling populace reaches far higher numbers, the number of timer manufacturers does not increase in proportion, and it would appear that production difficulties make it necessary for them to charge considerably more for their products, almost as much in fact as some of the cheaper motors themselves!

Why not save this expense and just fit a coil of fuel tube on the fuselage side and let the model go when the level reaches a set mark? We use this form of simple fuel limitation for sport flying and it works admirably—for sport flying. Time the motor runs on a sequence of flights and the variation in seconds will surprise you. This system then is not for the contest man who wants and needs precision if he is to win. He *has* to use a timer and it is up to him as to what type he selects and how he eventually makes use of it in the model.

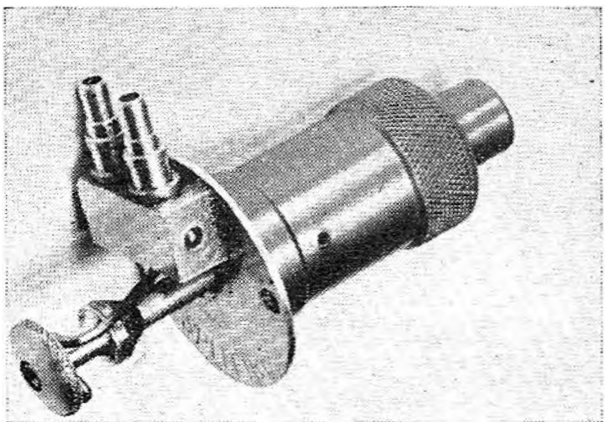
One would think that the aeromodeller might respect this item of precision into which so many hours of tedious development have been poured by the struggling manufacturers. I have seen a modeller oh so carefully wrapping the exhaust ports and intake on his diesel, yet completely neglecting to clean away the mess this pet engine of his has made in the vital area around the timer valve and plunger. And yet if left in that state and taken to the field again on the following day he will be only too ready to blame the timer and not himself.

A good workman never blames his tools, and the pet aversion of any power modeller should be for him to see even the slightest trace of exhaust mist around his timer no matter what the type. Why? Well in the case of a clockwork timer the added and doubtful lubricative effect may be thought to be helpful, and so it might on the day in question. Should the oily sludge filter through to the spring and delicate gear train and remain there for days, then the duration of that timer will certainly fluctuate with day temperature according to the viscosity of the sludge. After all, you wouldn't lubricate your wrist watch with diesel exhaust and expect constancy from the works—or would you?

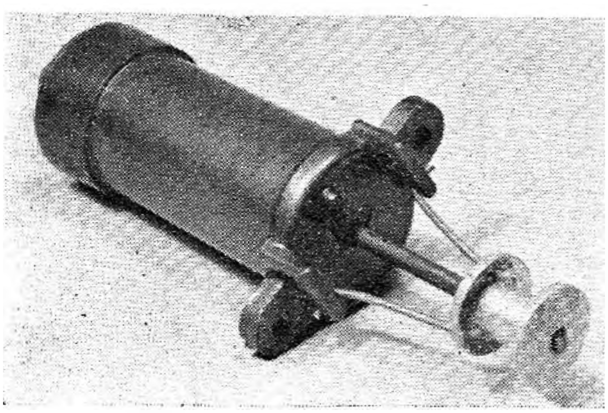
In the case of the airdraulic unit the same theory applies, with operation dependent upon the heat of the day, according to the thickness or viscosity of the sludge on the cylinder wall: but far more important is the effect of oil in the



The American Spitfire timer is comprised of many machined parts and is extremely robust for its light weight. Meant to be taken apart for between meetings overhaul and cleansing, the Spitfire is a "complete" timer with a shut-off valve in the top flange. Cupped neoprene washer is held in a turned plunger, and spring is tapered for the short stroke of this unit. Elmes type valve is used.



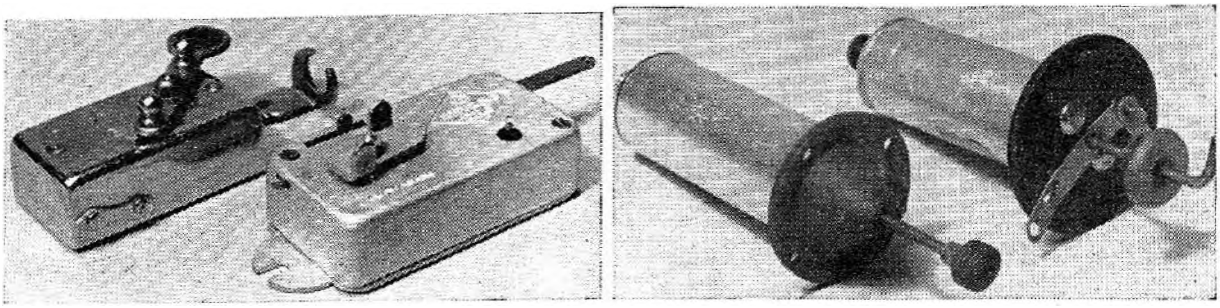
Above: Short stroke of the Spitfire is indicated by the fact that the plunger is withdrawn here and ready for action. Knurled body enables easy dismantling and intake hole can be seen near the upper portion of the cylinder. *Below:* Another American product, the less expensive Hillcrest, is all plastic and suffers from lubrication or heat variations. Fuel tube is passed over a hump and through lugs on the top flange, to be nipped by the snap-in plunger head.



valve. An airdraulic timer works just like a bicycle pump. When the plunger or "Stem" is withdrawn, air is taken into the lower portion via a small hole in the wall or past the sealing washer and on release, the spring tension on the washer (likened to a piston) forces the plunger down, at the same time compressing the air in the lower cylinder. To allow the air to escape at a constant rate a valve is used and this, of course, regulates the timer for the desired air-escape rate and has a screw setting. This same screw setting provides a means of restricting airflow out, as it has to filter past at least 3/16 of threading, and in addition a needle valve or sponge rubber pad is employed to give the actual regulation. Tightening the needle valve upon its seating works just as simply as the accustomed carburettor control on our engines, and squeezing the sponge rubber pad—one of Dennis Elmes' many brilliant notions in model timer design—gives an even less sensitive control. Imagine then what happens when exhaust sludge gets beyond the plunger and into the "pump" portion of the timer. Air pressure sends it straight to the valve, where the viscous mixture fills the sponge rubber or blocks the needle seating and slows the timer speed. (It should also be noted that if adjusted *without* cleaning when there is fuel exhaust fouling the valve and interior, a timer will work erratically though effectively; but will be liable to snap in suddenly should the valve clear itself.)

Moral number one. *Keep the timer clean.*

When we buy an engine (unless it is a Fox 35) we expect to have to run it in carefully for a "break-in" period to settle the bearings and improve the general fit



Autoknips and E.D. Clockwork units are favourite mechanical timers, while the Gremlin and Snip at right are now outdated, though still in regular use in many parts.

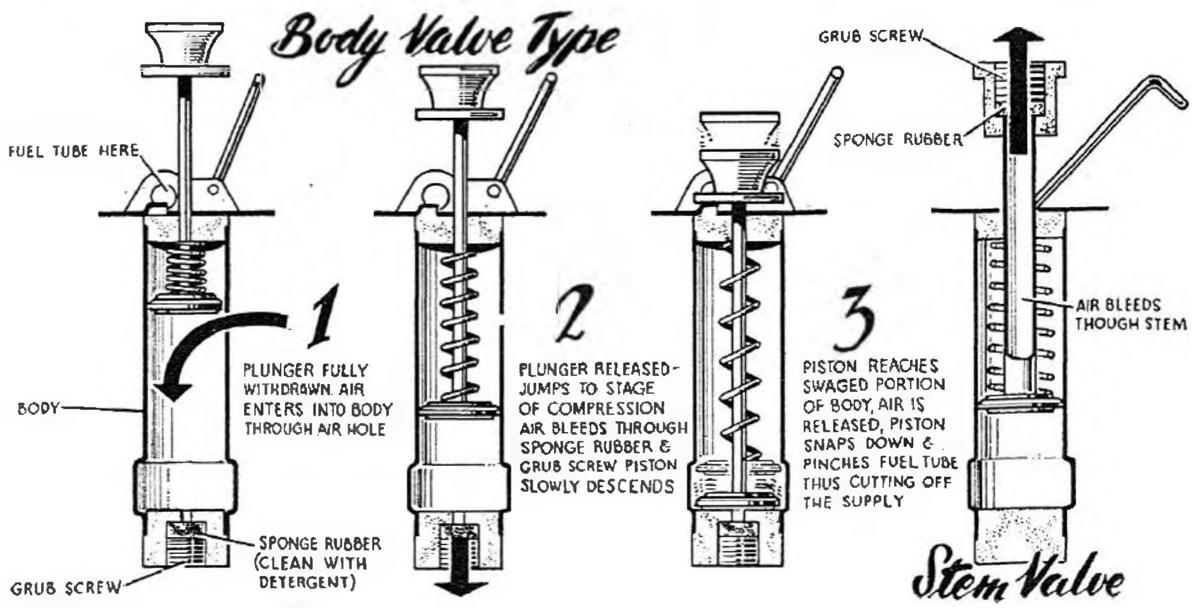
throughout. A timer is rarely regarded in the same light and usually gets its first pull or wind when firmly mounted *in situ* on the fuselage. This in itself is a great error, for the flexible plunger washer in the timer requires a number of strokes before it can align itself perfectly to the cylinder, and for perfect self-lubrication it should be fed with minute quantities of graphite grease through the intake hole during a precautionary "run-in" before fitting to the model. Castor oil is also recommended sometimes as a lubricant; a tendency to "overdose," however, can reduce reliability just as much as ingress of exhaust gases.

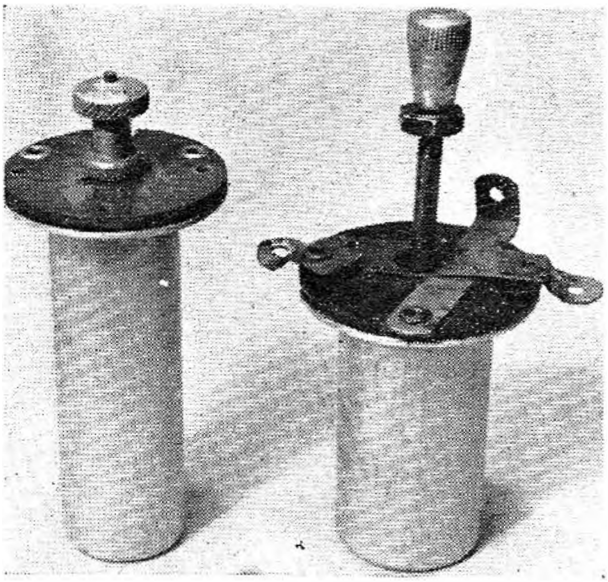
Moral number two. *Use graphite grease lubricant.*

What to do when the timer is obviously suffering from too much fluid in its internals is now happily remedied by the introduction of washing detergents, the names of which will be familiar to modellers in all countries, especially the married modellers who have to do washing-up after meals. Immerse the timer, clockwork or airdraulic, in a strong detergent solution, pump or wind to ensure circulation, and dry out. It works like a charm, and re-lubrication with graphite brings operation back to normal. Of course, the valve should be completely removed for washing, and the sponge rubber specially cleaned and replaced absolutely dry.

Moral number three. *When in doubt, clean it out.*

It is not an altogether unnatural characteristic of modern youth to wish to go one better than his neighbour, and to start to "improve" his engine or





Early American timers, the Austin and Berkeley Airdraulics, each of the leather-washer brigade, and the former still held in high regard by many who treasure possession through the war years. Snap action can be employed with either of these by grooving a bypass in the thickwalled cylinder.

timer immediately after purchase. Common thought is that the E.D. clockwork unit operates too slowly, and out come the snippers to clip the governor and make it a speed job. Yet if only the winder arm is removed and replaced at 180° to the original position, the average E.D. will give a powerful 20 seconds run on one single full wind instead of the usual 65 seconds at lower spring tension. So there is no need to alter the clockworks, which were after all designed by one who should know and understand the requirements of such a timer. Airdraulic units are quite fortunately so constructed that any ideas of modification are stifled at first thought, the usual riveted construction serving as an effective "mod" discouragement.

Moral number four. *Leave it alone, or make your own.*

This way we cover the subject of timers in general—now, what do they operate? There are three types of cut-out in use: the ignition switch, now outmoded by the introduction of the glowplug; fuel strangulation via another valve valve or nipping a flexible piece of tubing; and introduction of air bleed in the fuel flow, now regarded with ill-favour due to delay in effective cessation of two-stroke activity. Then there is the dethermaliser timer, a type which I might predict will eventually come into its own when fire risk with the standard slow burning fuse in current use becomes a subject for concern with local authorities.

Those, then, are the types of timer existing today, and the basic means by which they are employed. That some are supplied as bare units requiring adaptation for tripping separate cut-out and others are complete in themselves again brings up another important point of reliability, and that is the subject of spring tension. All timers have this item in common, the airdraulic coil spring and clockwork flat spring each supply the motive power to make that final and most important action to stop the motor run. Tension is therefore of extreme importance, particularly with the "incomplete" timer which has to make use of a separate cut-out device. For although a timer may be as consistent as the most meticulous modeller demands, that last motion of the plunger is all-important and should be checked regularly. In the case of the fuel tube nipping type of unit, always ensure that the tubing is supple and nips easily and that the little hump underneath the critical part of the tubing stands well proud of the timer top, for this is the item that makes sure of flattening the tube when the plunger slams in. With clockwork units, power falls off as the "unwinding" action occurs and a sluggish unit can be left with insufficient power at the end of the run to trip the shut-off—so—

Moral number five. *Check the action frequently, especially final plunger motion.*

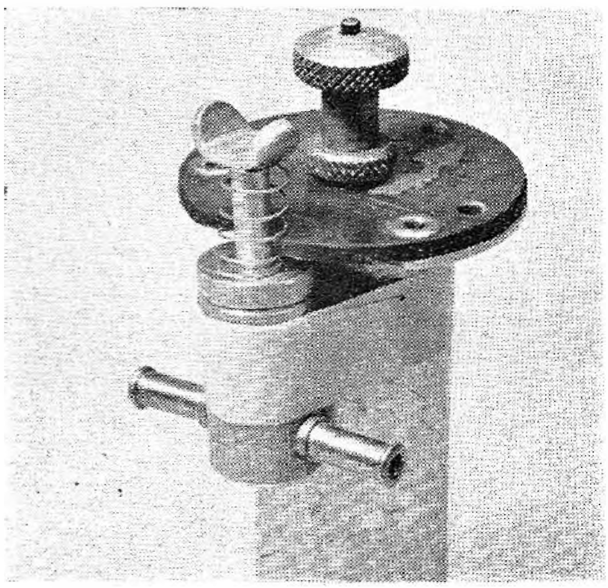
Just about the best way to spoil tension in the coil spring used inside the airdraulic units is for the cocking arm to be left at action stations for a long period

and thus holding the internal spring in a depressed state. If it is a nipping timer, removal of the tubing is a simple matter, and the timer can be left between flying days with the plunger at full "in" position. This also allows the plunger washer to remain at rest in the bypass area of the cylinder, where it is of extra diameter, and so less tension is brought to bear on the washer edges and it is allowed to maintain its full flat and circular shape for the next duty call. Clockwork also benefits from being left in the unwound condition, though care should be taken to note that complete relaxation of tension on the timer spring might mean constant tension on the far less robust but equally important cut-out spring, so the best plan is to hold the clockwork timer between outings at the just before tripping stage. Which completes our moral series with—
Moral number six. *Relax the spring when not in use.*

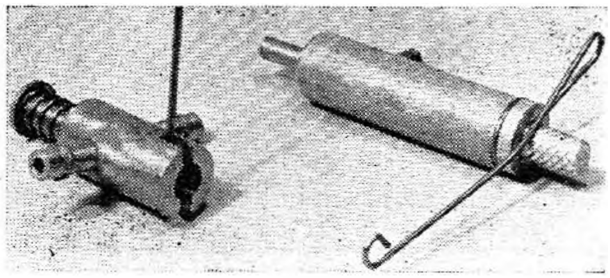
Timer care now emphasised, let us examine the units that are in use throughout the world today and assess their particular virtues and vicissitudes. By enlisting the co-operation of Eddie Keil, Ron Warring and George Fuller I found myself able to lay hands on no less than eighteen completely different timers and a set programme of test checks was planned, though at the time I had little idea of just how long each stage in the test was going to take. The final results are tabulated here, and a quick scan of the columns illustrates immediately the exact purpose of this survey. The *in*frequency of the desired and set figure of 20 seconds after the initial column only serves to demonstrate the sentiments expressed by Dave Kneeland at Cranfield, and the general variations will be appreciated by all keen contest fliers. We are dealing in seconds and half-seconds here, and all quotations are averages of three or more operations—sometimes more in the case of the few gems of consistency in the hope that some slight flaw be detected to justify our troubles! Any variation, even as much as 0.5 second, is undesirable, especially in the flight-to-flight test with added vibration from a fast-running engine; but the fact remains that variation appears to be unavoidable and it is up to the modeller to try to minimise the possibility by observing the foregoing simple precautions.

Dealing with the fifteen examples actually subjected to the survey, the following notes will be of interest.

Spitfire made by Mel Anderson in the U.S.A. is an unique airdraulic timer in that it has a detachable body to facilitate cleaning and taper coil spring to compress fully for the short stroke. Turned body is thick-walled and the solid top plate has an integral shut-off valve with a plunger operated directly from the stem knob. Valve is Elmes type with sponge and grub screw, timed to regulate at 20 seconds taking only 5 minutes. Faults are, that incorrect fitting of wrong nipple from cut-out to engine can give a delayed motor-cut until



How a pre-war Austin timer can be put to good use with a Bat type push-off valve is illustrated by this mock-up. Link between plunger stem and the valve should be fitted to obtain shut-off action.



Two commercial cut-out valves, the Mercury and Arthur Mullett types are to be commended for sure action, but only serve to fill a duty that should be responsibility of engine or timer manufacturers.

fuel flow is exhausted between timer and motor. (Change around of fuel leads avoids this.) Also, being short stroke, it is essential to ensure full withdrawal of the main plunger to obviate tendency to snap in quickly on occasions. Sterling equivalent price is £1.

Another American timer with integral shut-off valve is the **Austin** Fuel-off, which is the latest of a long line of pioneer airdraulics by the Austin-craft Co. Leather washers were characteristic of the marque, and the lack of an intake hole in the body mystified most people, though the latest fuel-off type has this feature, but still retains the beautifully-fabricated needle valve in the stem and pressed aluminium body. The fuel-off is not quite so consistent as its predecessors, two examples of which were checked and found very similar in spite of a five-year production date variation. With long stroke, no by-pass action and very easy adjustment, the early Austin retains great favour, and in combination with a push-off type of valve such as the "Bat," it has much to be said in its favour, particularly if an additional air hole is drilled for intake, and a by-pass grooved in the lower body. Faults of the Austin series are that the operator can alter the setting in his enthusiasm to withdraw the plunger before a flight. The fuel-off also appears to be cold-weather sensitive. It sells for the equivalent of 15/-.

Prewar supplies of the big-bore **Berkeley** airdraulic were held in high esteem by power modellers of that day; but seconds were less critical in those years, and on that score this timer, of needle valve type, does not fulfil all present-day requirements. It does, however, compare favourably with some of today's productions, notably the all-plastic **Hillcrest** glo-cut timer of the tube-nipping type with plain set screw valve and no sponge rubber. This timer is made in warmer climes of California, and seems to favour high temperatures for obtaining anything near to consistency. It is highly lubricant sensitive, especially if castor oil is employed. Solid lubricant, like graphite grease, should be used, but seems to promote a sticking tendency if left. Selling price equivalent is 10/-.

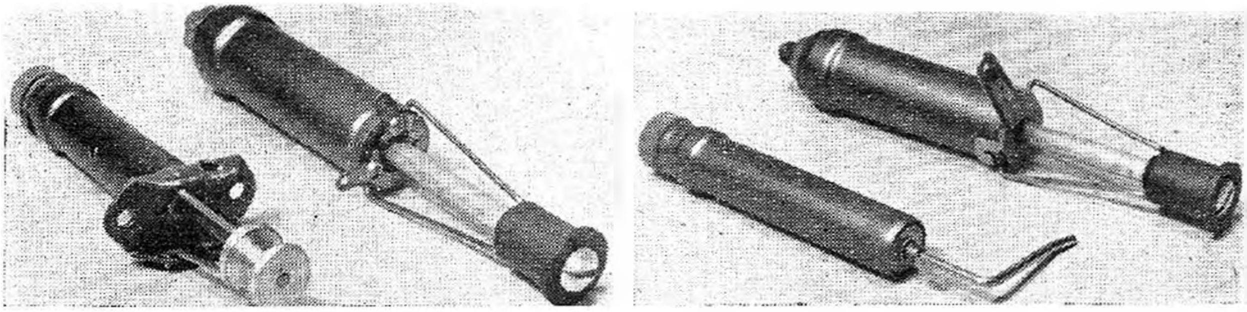
The immediate postwar boom in airdraulic timer manufacture in Great Britain was set on the right path by the **Snip** series, devised and marketed by Cyril Shaw. Plastic valve bodies, side intake holes and some of the first snap action timers came in this series. They were, however, inconsistent in manufacture standards, though the tested example of the petrol type would have passed in favour in its heyday of 1948. Valve was a simple 10 B.A. screw setting of annoying sensitivity, time to obtain 20 seconds being anything up to an hour's tedious trial and error. Utilising an identical barrel, but with more streamline appearance and a needle valve, the **Gremlin** was a great improvement, though it had the disadvantage of falling to pieces at the critical moment! It had internal points for a petrol switch, and although the tested example can be said to be a good one, it still falls short of present-day needs and is in any case impractical for anything other than electrical switching. Which brings us to the popular **Elmic** series, designed and cleverly engineered by Dennis Elmes, of Scorpion Motors Ltd. Reference shows that the five Elmic types in current production were tested, and that the diesel type shines as an example of rare constancy which is backed by the fact that most of Britain's leading power fliers use this type. The Mini-Diesel is less bright, its body type valve being tedious to set, and the dogmatic manner in which the timer settles to a constant but completely different figure is apparently typical of this small diameter unit. Yet the same body valve works magnificently for perfect setting over 5 minute periods on the Baby d/t timer which is a rarely-appreciated gem. Elmic ideas abound with clever light engineering practice, the two-diameter barrel for a by-pass and reversing washer "flow," the first really reliable electrical contacts on the petrol version, the first successful approach to tube nipping and the cocking action of the diesel type are all Elmic "firsts" which have seen the light of day. Countless other experiments to improve the timer, involving thousands of hours of labour, must have gone into the Elmic scrap bin. Properly looked after, the Elmic diesel and d/t types rate high in the efficiency table.

Undoubtedly top of the poll in tests is the heavyweight camera timer with the fantastic 3 lb. spring tension and clockwork action, known the world over for many years as **Autoknips** and made in Germany. Selling in the region of 25/-, this type is not always easy to obtain, but is valued by those able to afford its weight and cost. A copy unit for model work is the **E.D.**, which is considerably lighter both on the pocket and in the model, being a favourite of many leading fliers and fairly consistent, depending upon propeller balance, and

TIMER TESTS AFTER ORIGINAL SETTING AT 2 SECONDS

TIMER	Valve Setting at 60° F. (seconds)	Check after 24 hrs. at 60° F.	Check after 48 hrs. at 60° F.	Check after 60 hrs. at 95° F.	Check after freeze at 30° F.	Check after de-freeze at 60° F.	Check after 14 days	Check on fuselage with engine running	Flight to Flight Consistency %	Weight in Grains (437.5=1 oz.)	Pull test on plunger (ounces)
Spitfire	20	20	20	18	25	20	22	22–23	95%	150	30
Austin Fuel-Off ...	20	26	26	23	45	22	29	23–24	96%	210	23
Austin Petrol '39 ...	20	22	23	22	34	21	22	23	99%	248	12
Austin/Bat '44 ...	20	22.5	22	21	26	22	25	25	99%	308	12
Hillcrest	20	23	23	22	28	24	83	21–25	84%	110	20
E.D.	20	20	20	18	18	20	20	23–23.5	97%	418	10
Elmic D/T	300	285	305	300	265	300	300	300	100%	80	26
Elmic Diesel ...	20	20	20	20	19	20	20	19	99%	145	28
Elmic Mini-Diesel ...	20	13	13	13	9	13	13	16–17	92%	114	28
Elmic Glo.	20	16.5	15.5	15.5	14.5	15.5	15.5	18.5–19	95%	135	28
Elmic Petrol ...	20	19.5	19.5	19.5	17.5	19.5	19.5	20–22	90%	136	15
Snip Petrol ...	20	21	23	19	30	25	25	17–24	72%	137	18
Autoknips	20	20	20	20	20	20	20	20	100%	583	48
Gremlin	20	28	30	22	27	32	30	22–25	88%	176	16
Berkeley	20	20	22	18	20	20	20	23–24	96%	308	14

Each of the figures quoted in the first eight columns of the above table is an *average* taken from three or more separate readings. All timers were initially set to twenty seconds (some taking up to an hour to obtain this accurate setting) and the infrequency of this 20 secs. figure in columns two to eight serves to indicate the degree of reliability or otherwise of the modern timer.



The Elmic Mini-diesel and Petrol timers *at left* are very popular units, but the survey of timer operation shows the pair *at right* to be the better of the Elmic series. These are the Baby d/t and diesel type, which utilise a clever cocking arm system to operate a cut-out.

general vibration. Pre-flight test runs of both timer and motor should always be made at every contest, and especially so in the case of using an E.D. unit.

Conclusions

If we are still unsatisfied with today's timer situation, what then can we request for the future? Why not a timer/tank/cut-out unit? Why not a dial type valve to set to the half-second? Why not a unit independent of vibration, fuel viscosity or air temperature? The task sounds a simple one, but remember that the timer makers have been struggling toward such an end for a good many years. To make a pun—time will tell!

And what if we do get the perfect timer? Shall we eliminate these possibilities for losing or gaining seconds of power run.

1. The time delay between timer release and model launch.
2. The time delay between timer operation and motor cutting.
3. The time delay for sound to travel between model and stopwatch.
4. The time delay between operator and the stopwatch.

They add up to quite a few split seconds and serve to remind us of the forgotten human element which is so often to blame when that awful word "Over-run" is heard across the field.

Just to add to the inference that the modern timer is not all that we should desire, news comes through as the closing words of this article are written that the author's F.A.I. model was the subject of considerable timer trouble at the '54 World Championships, Long Island, U.S.A. During the course of the contest, two flights of maximum and near maximum duration were disallowed due to a one-second over-run in each case! So even the best-kept and cared for of airdraulic timers (though I would hardly care to set up myself as an example on this score), is not without a slight indiscretion now and again, especially, it seems, on the occasion of the most important event in which it is ever likely to partake! And as if to make the irregularity level pegging for both airdraulic and clockwork, we cite the case of Silvio Lanfranchi, whose outstanding '54 placings in the European and World Championships show him to be second only to the best, and who suffered the ignominy of no less than *three* over-runs at the Northern Gala, Darlington. This only six days after taking part in the U.S.A. contest with the same model and trouble-free timer operation!

Manufacturers . . . please help. Modellers . . . send in your timer suggestions, we will be pleased to pass them on to the right quarters so that, *perhaps*, one fine day, we shall have a unit to be praised and not abused.

OSSI CZEPA ON AIRFOILS

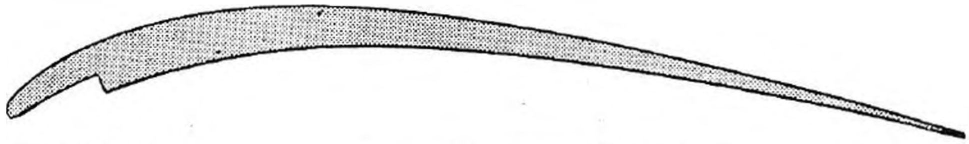
As soon as man desired to fly he started studying nature's model, the bird. But the time came when he realised that big aeroplanes were subject to different physical circumstances, particularly in relation to lifting sections. Measurements were taken, and eventually new especially adapted profiles for full-size aeroplanes were found.

These successful labours were then taken over by aeromodellers who believed they were already producing peak performance with their model aeroplanes. It's human nature, however, to try constantly to improve, and some people in the model movement began to experiment with forms of profile at model speeds. The results were quite astonishing.

Applying Reynolds formula (Reynolds Number of a wing $= 6{,}300 \times V \times L$, $V=$ speed in ft./sec. and $L =$ Chord in feet) which gives the relative boundary layer flow over the wing, modellers found that the existing profile measurements were no longer valid. Measurements for Re 150,000 were carried out. During this experiment each profile entered a critical zone in which boundary layer became turbulent. Formerly the laminar flow clung to the surface and the model showed an ordinary drag. It is only possible to compare Re number for different profiles where the test wing is of the same chord operating at the same speed. It is desirable for the model to fly near to the critical Re number for the particular profile in use. Formerly when thick profiles were used which had been taken over from full-size planes their performance was either "over critical" or "under critical."

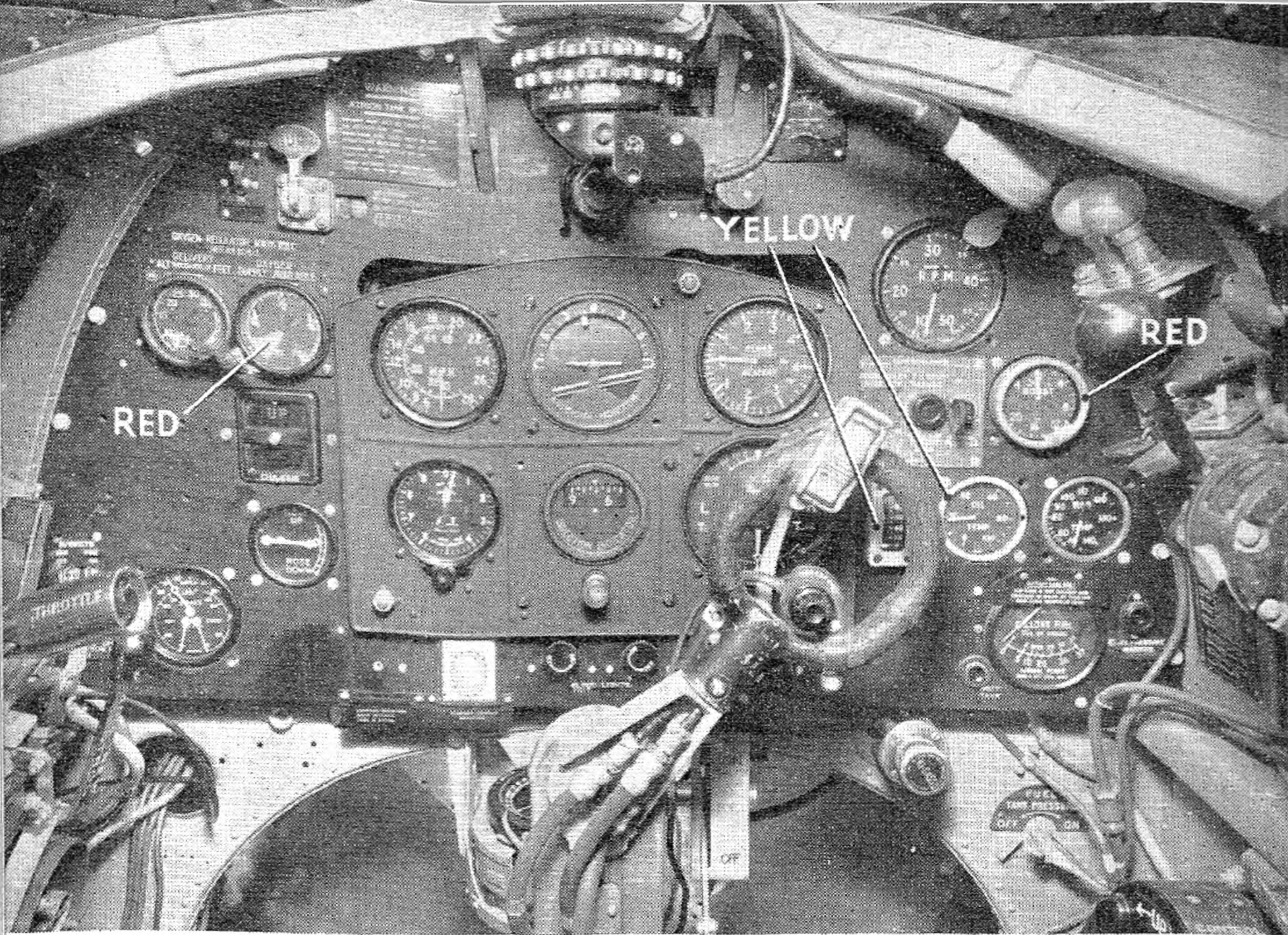
Two direct methods are possible, namely, through wing chord and speed of flight to get a high Re number. While the first approach is more or less useless, with the second also a certain limit is set, namely for the depth of wing (Induced drag). An indirect method consists in making a turbulent boundary layer and so bringing the critical Re number lower down. Aids to this are the point of entry of the profile section, the nose radius, and the wire turbulator and the elastic turbulator, and finally a very slim profile of a special form.

Sharing all this knowledge after the war in Vienna was a small group of model flyers. We envisaged the proportion between the different profiles as being the same as between a butterfly and a small bird, a middle-sized, and a large bird. We came, therefore, optically to the conclusion that the form of the profiles played a critical part in their performance. We confirmed our theories later on in practice. At the moment we are using medium wing depth profiles with maximum 10% upper camber height and almost 5% chord thickness ratio. The most advantageous position of the highest arc lies at 30% to 40% of the depth; further we found out that with the use of highly cambered profiles the possibility of a sudden transitional flow on the lower surface of the profile was minimised. To remedy this, for example, the Eagle was developed as shown here with a spanwise step to break the lower surface flow. A simpler example is the one in profile C.514 which is built on the Toothpick principle which resembles the Eagle profile somewhat in that the possibility of undersurface breakway has been encouraged as far as possible.

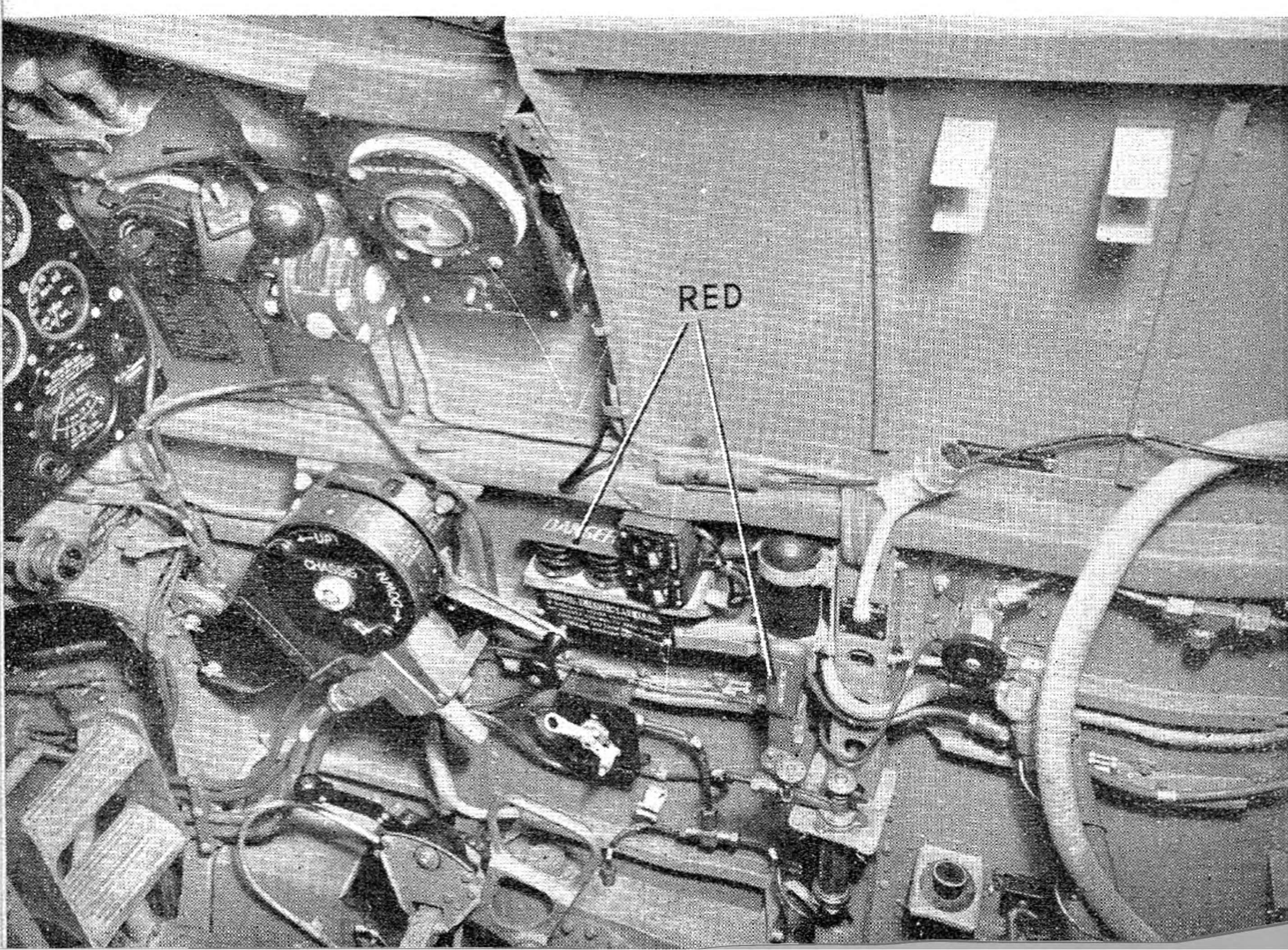


On left :
EAGLE AIRFOIL

On right :
C514 AIRFOIL



These three photos show the cockpit of the Spitfire Mk. IX Fighter whose interior differed very little from the Mk. V. The rudder pedals and curve of the fuselage former can be seen below the instrument panel. Undercarriage selector on right hand was peculiar to Spitfires, among single-engined aircraft. (*Photos by courtesy of Vickers Armstrong, Ltd.*)



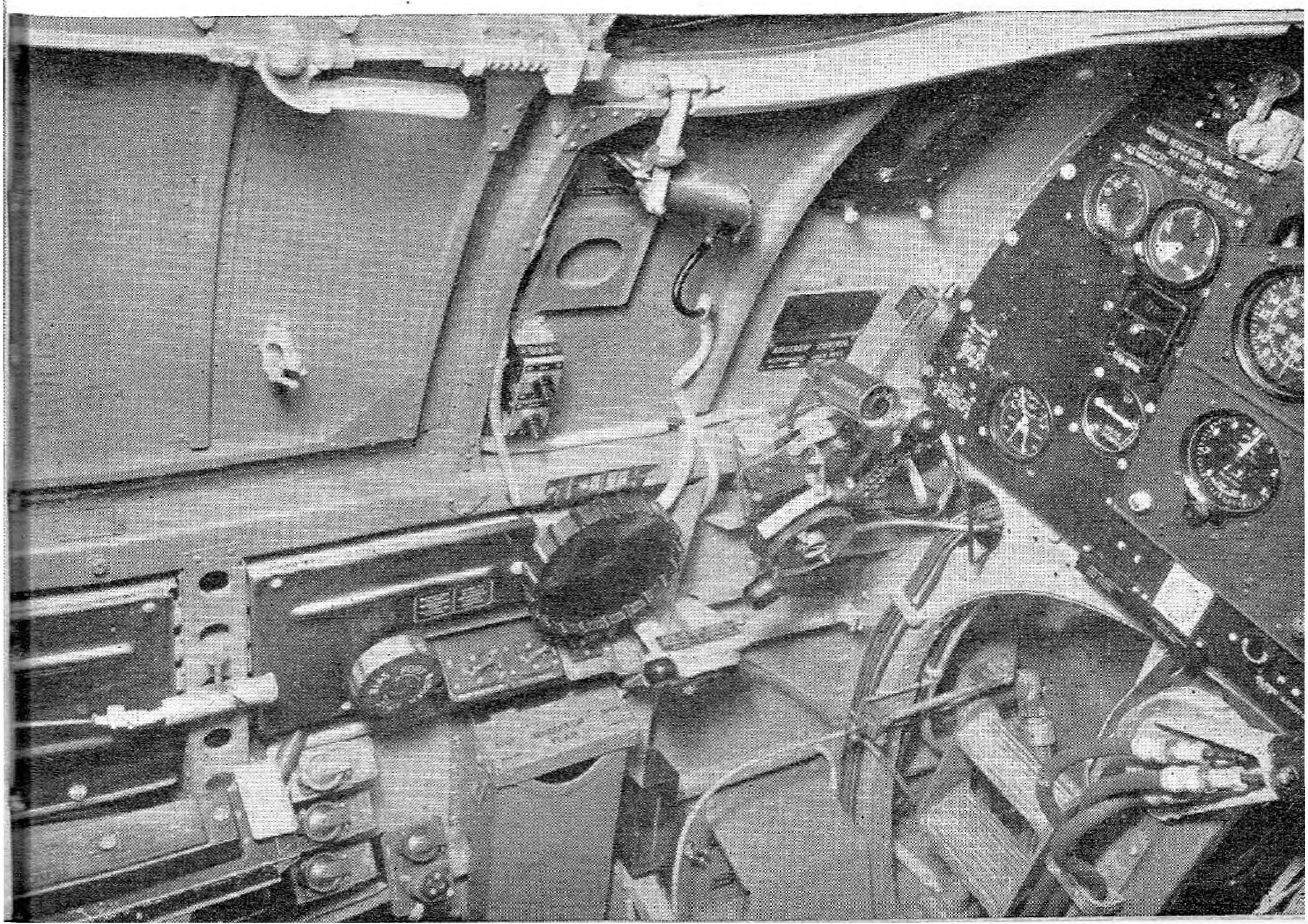
INSIDE STORY

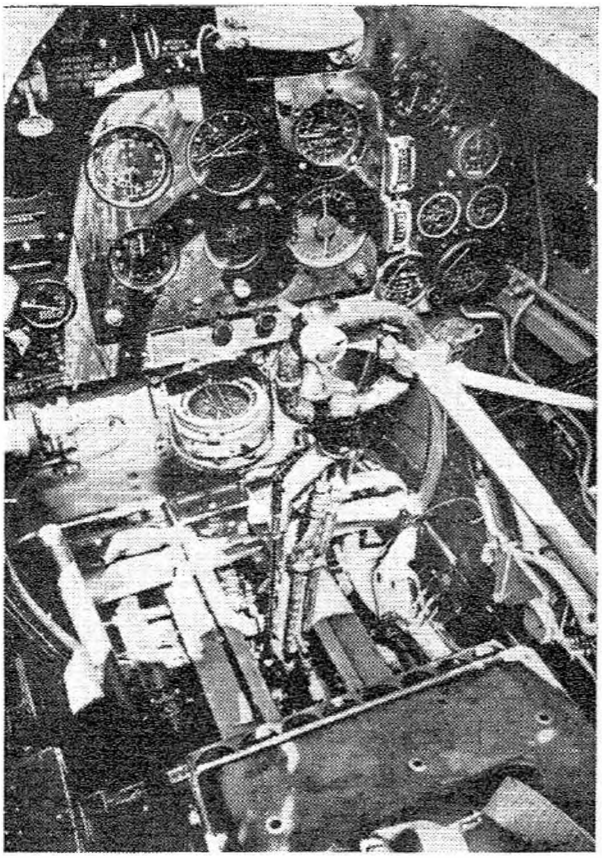
By G. A. CULL

The Real Thing

"NOW what do we do with the cockpit?" is a question that crops up during the construction of every scale model, be it flying or solid scale, and the answer is not usually sorted out until a lot of head-scratching has been done, so let us probe into this intriguing place, the cockpit.

Whereas it is relatively easy to become familiar with the outside of an aircraft, we don't often see the "innards" and illustrations seldom appear in readily obtainable books, so perhaps it is some consolation that the next man is unlikely to know any more of the subject that the builder! All cockpits have features in common, namely the flying controls consisting of the joystick and rudder pedals, and there are also the instruments, compass, seat and safety harness, and no scale model can really afford to be without them. These items may not be practical in some flying models, particularly in the case of rubber-driven models, where the motor would be obstructed, but an instrument panel, even if cut away for clearance, is better than nothing and forestalls the suspicion that the builder "didn't know what to do with that bit," which an empty cockpit so strongly suggests. With 1/72 scale and smaller solid models a single-seat cockpit is seldom wider than 3/8-inch, and by the time these bare essentials are in place it is impracticable to add extra "bits." At the other extreme is the flying scale or non-flying built-up model made to a large scale with an open cockpit (which all the best full-size aircraft for flying scale modelling seem to have), where it is a case of the more the merrier with cockpit fittings. Although the features already mentioned are common to all machines, their actual configuration differs according to the type of aircraft, and so it would be very wrong to

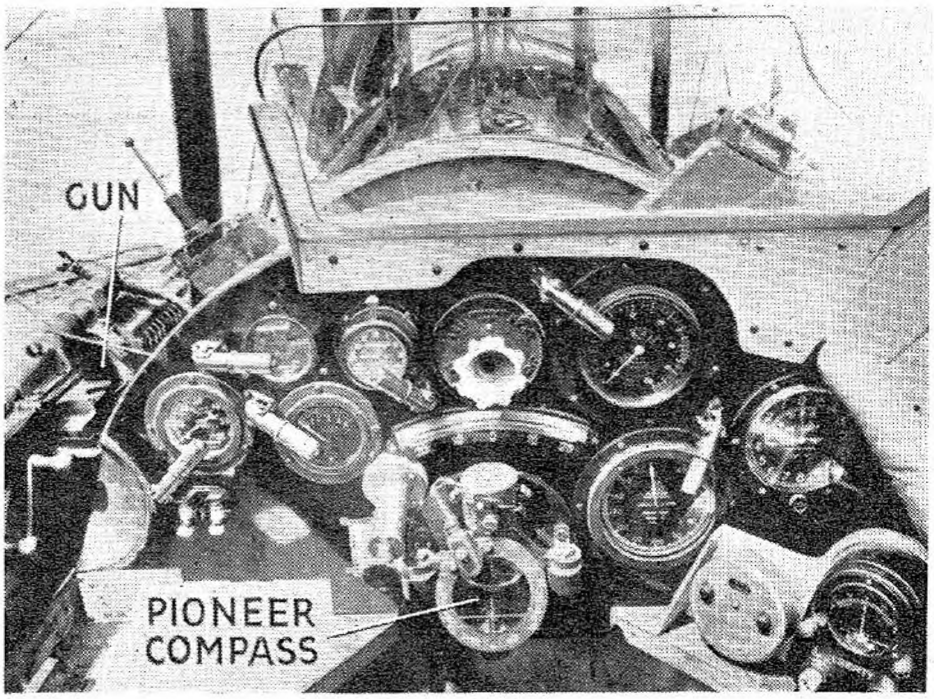




A "Battle of Britain" cockpit—the Spitfire Mk. I. Notice the parachute in the seat, rack for Verey pistol cartridges in front of seat, no real floor and two removable struts holding spade-grip to lock controls when machine is parked. (*Photo: Imperial War Museum.*)

turn out a model Auster with a joystick topped with a fighter's spade-grip. Broadly speaking, the cockpit interiors of military machines are quite different to those of civil machines, and in both classes the inside of the low-powered type is a much simpler story than that of a high performance aircraft.

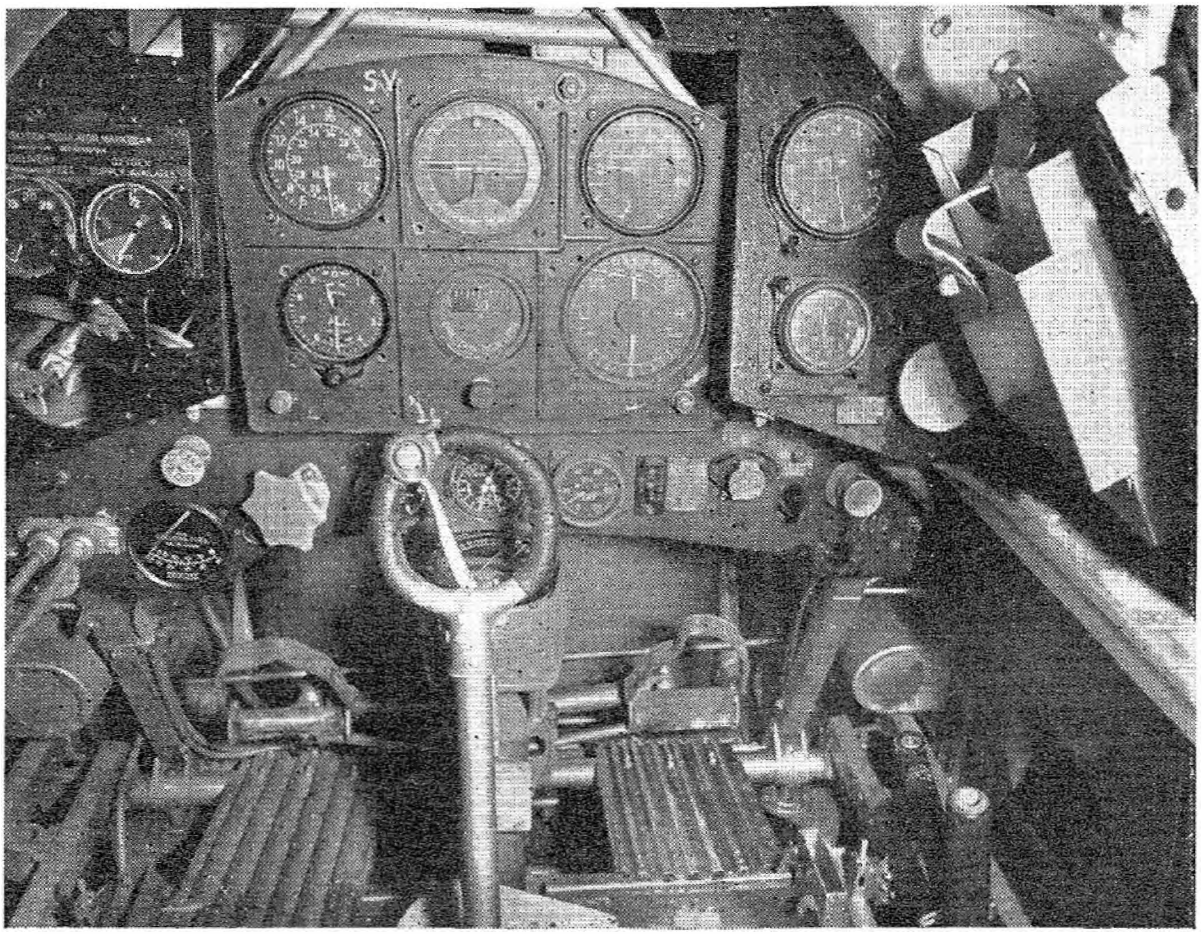
Military aeroplanes are designed to do a definite job of work and there is no need for good looks to be taken into account in cockpit layout, nor is luxurious comfort provided for the pilot—far from it in some cases. On looking into the cockpit of a 1939-45 fighter—and more models must have been made of these machines than others—we see a bewildering array of bits and pieces. Starting with the instrument panel we find it is more or less shaped to fit the inside of the coaming forward of the cockpit and its lower edge, while generally straight, may extend lower with cut-outs for leg clearance. In the centre is the blind-flying panel which is separate and rubber-mounted and usually stands proud a little. This contains the flying instruments, namely, air speed indicator climb and descent indicator, artificial horizon, altimeter, direction indicator, and turn and bank indicator. The rest of the panel is occupied by engine instruments

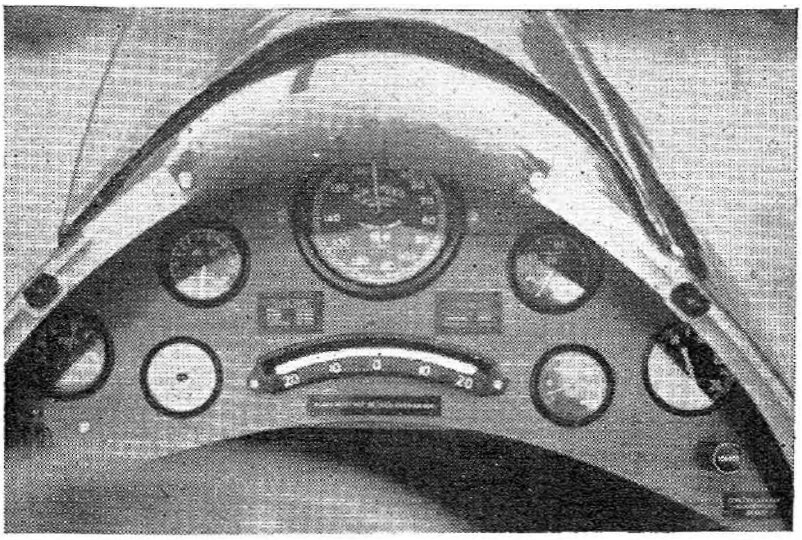


Left: D.H.9A.—A 1918 Day Bomber. Much brass and the complicated compass are on view, and the top of the stick can just be seen. (*Photo: Imperial War Museum.*)

Right: The Gladiator pilot's arena. In the photo the guns are not fitted, but the blanked off ends of the blast-grooves are seen. Note heel boards. (*Photo by courtesy of Gloster Aircraft, Ltd.*)

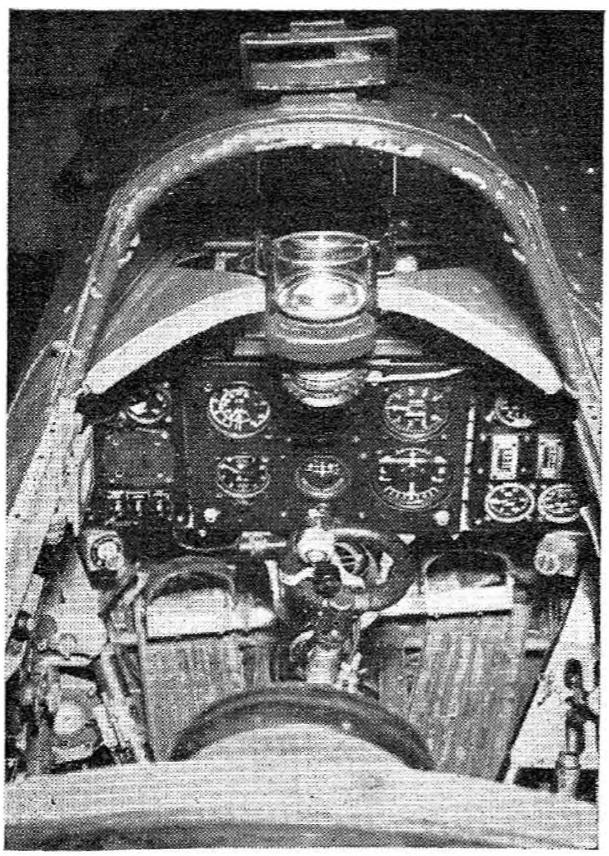
grouped together, oil pressure and temperature gauges, rev counter, boost gauge and radiator temperature. Other dials are for brake pressures and oxygen, while other items are compass deviation card, data plate(s), u.c. indicator, and various switches for magnetos, navigation and landing lights, gun sight, etc. The instrument panel is surmounted by the gun sight and the compass is usually slung beneath the panel. Engine controls, throttle, mixture and airscrew pitch, are mounted together on the port side of the cockpit, and the trimmers lower down and to the left of the seat. Controls for undercarriage, flaps, morse tapper, seat adjustment, emergency systems, etc., are fitted into the remaining space. A fact that is not always realised is that the fighter cockpit has no proper floor. When in the cockpit the pilot's feet are on the rudder pedals and the space beneath him is occupied by structural members, control rods and/or cables, pipelines and probably the hydraulic reservoir. The pilot's seat is invariably a sheet alloy bucket type with the seat recessed to take the parachute on which the pilot actually sits. This looks like a flat khaki cushion with a transverse slot through which emerge the white webbing straps of the parachute harness. Above the back of the seat is an armour plate tapering towards the top and on this is mounted a leather squab or pad for the pilot's head. The Sutton harness consists of four webbing straps with leather ends which have large eyelets. Two straps are anchored behind the top of the seat and the other two below the seat sides. The control column is hinged for sideways movement near the top, which comprises a standard spade grip with gun button, brake lever, and, sometimes, rocket and camera-gun switches. Various pipelines and cables are cleated to the control column and disappear into the depths of the cockpit. During the war R.A.F. day fighter cockpits were sprayed "cockpit green," this being a light





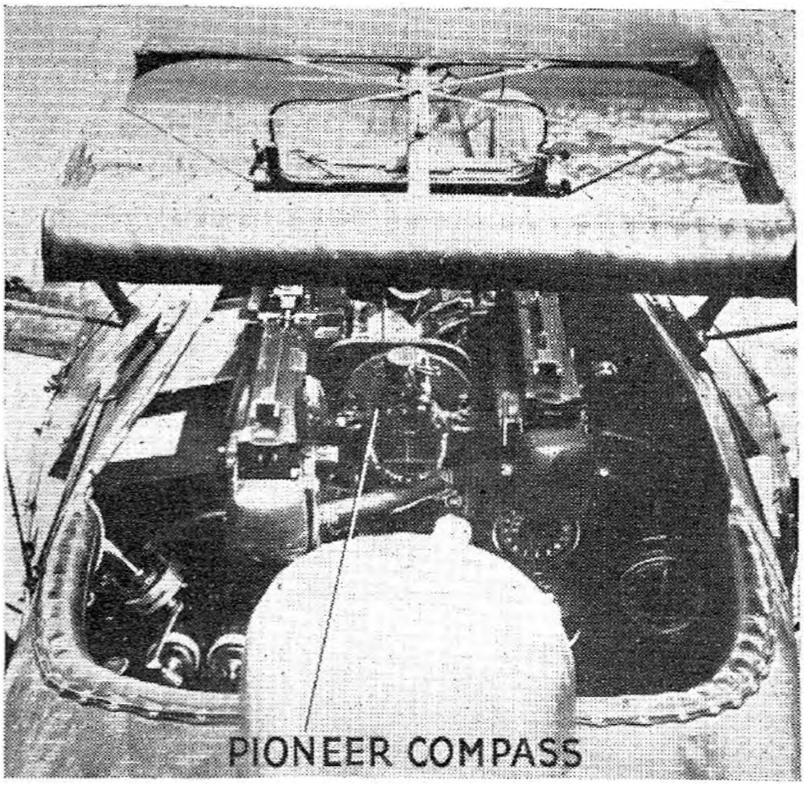
Chilton—ultra-light-de-luxe. The beautiful polished wooden dashboard of the Chilton D.W.IA. (*Photo: by courtesy of A. R. Ward, Esq.*)

pastel shade calculated to be the most restful on the eyes. The instrument panel is matt black and the instruments hâve luminous markings. Colouring is important on models and the one or two spots of bright colour are worth noting. Oil temperature and pressure gauges have bright yellow rims or bodies and the boost gauge has a red rim. Other red spots are fire extinguisher buttons and operating handles for emergency systems. The priming pump knob is dull brass and other handles may be dull aluminium finish, cadmium plated (dull silver), *e.g.*, de-icer and fuel cocks (which look like wingnuts), or anodic grey. Equipment bolted to cockpit walls is usually matt black, but dull aluminium shows through here and there, notably on the rudder pedals and heel boards, if fitted. These are narrow boards extending rearwards from the rudder bar and are found in most Hawker machines. The compass has a black rim, but the body is medium grey. Pipelines are mostly cockpit green, but are often aluminium. Other single-place cockpits, *e.g.*, Battle, Albacore, are generally similar to the cockpit outlined, but have far more room giving a less cluttered appearance and floorboards are usual. Twin-engined types like the Blenheim and Mosquito change to spectacle type control columns, have floors, and have flying and engine instruments grouped on the pilot's (port) side, and a portable table or shelf for the navigator who is staggered slightly to the rear in the Mosquito. The outstanding feature of large aircraft cockpits is, of course, the large number of instruments—mainly because a 4-engined bomber requires four sets of engine instruments, and the engine controls are centrally mounted on a pedestal for access by the co-pilot. Cockpit interiors of all R.A.F. night-flying aircraft were matt black and small



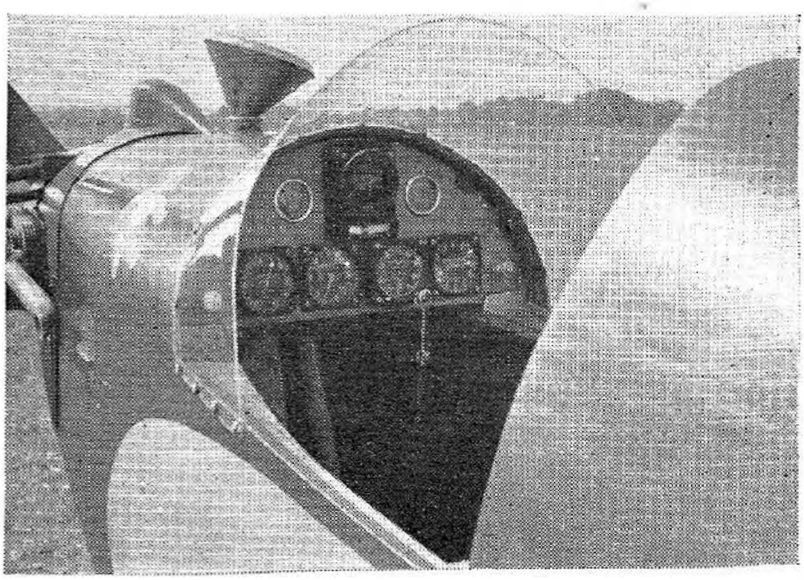
This is a Sea-Hurricane, but is similar to the R.A.F.'s Mk. I. The gyro-sight with pad is prominent. Squab for pilot's head, and Hawker tubular structural members are also visible. (*Photo: Imperial War Museum.*)

The W.W.I. Sopwith Salamander. The brass dials and switches are evident and the padded gun breeches are close to the pilot's face. Note that they are staggered and on different levels, also laced-on leather beading around cockpit edge. (*Photo: Imperial*)

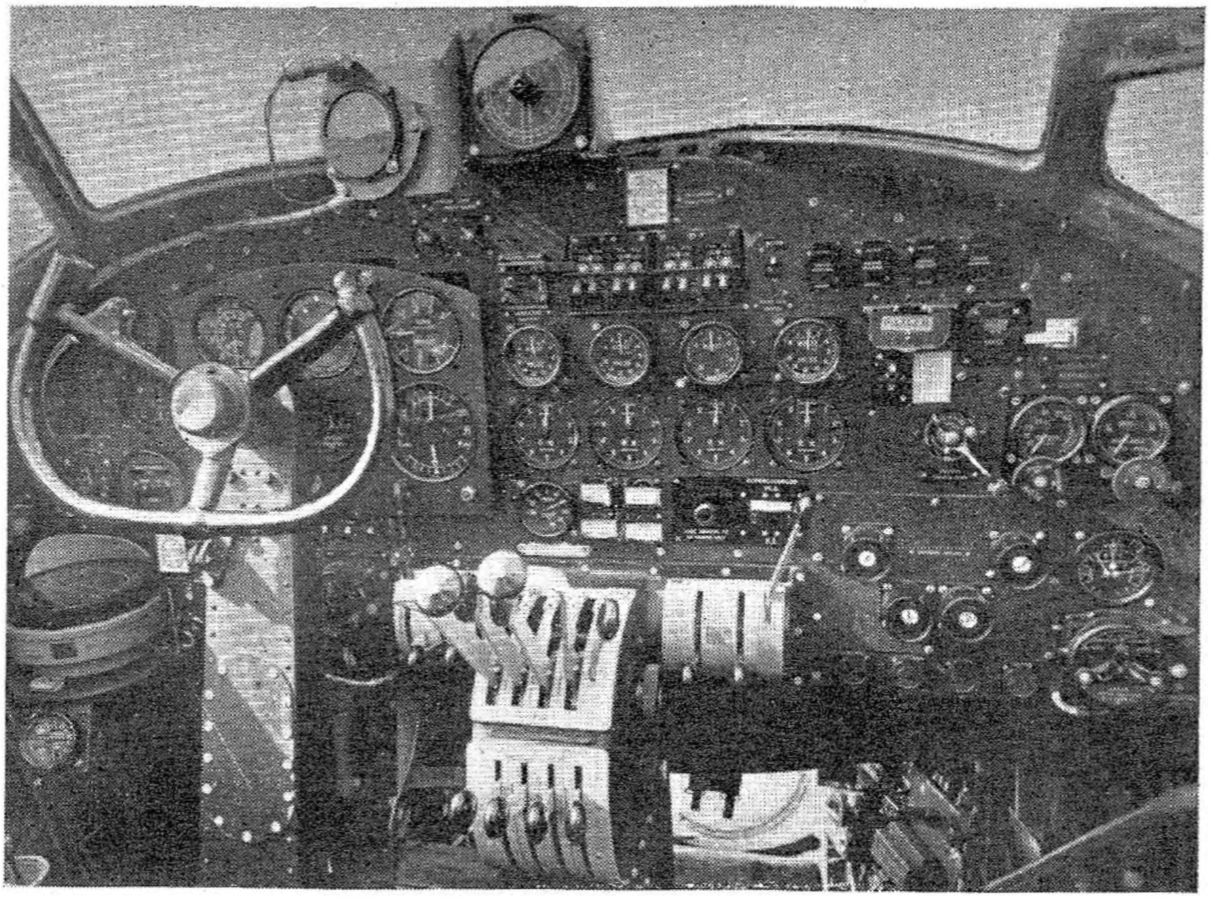


shielded lamps for instrument illumination made another item to be accommodated in the cockpit. Today the cockpits of high flying jets are matt black to eliminate glare above the clouds.

In pre-war days, when there was no cockpit green, a fighter's cockpit (biplane) showed much dull aluminium alloy finish on both structure members and the inside of aluminium cowling panels. The instrument panel was black, but contained fewer instruments, there seldom being a blind-flying panel and no retractable u.c. or v.p. propeller. Guns in the fuselage sides meant that their breeches were inside within reach of the pilot, and with only two guns, the time-honoured spade grip carried two "thumb-trips" instead of the brass firing button, these being small metal levers at the top of the stick and inside the grip. The stick was hinged at the bottom and there was not always a brake lever. In the late 1920's, when wooden fighters were still in service, the longerons and uprights were exposed in the cockpit as was the diagonal wire bracing. This was unchanged from World War I days when in many cases the stringers fairing the fuselage sides and the inside surface of the fabric was visible from the inside. The Sopwith Pup is an example of this. The exposed woodwork was varnished and early in the war many machines had varnished wooden instrument or "dash" boards, but before the end of the war the black panel had arrived.



The most popular ultra-light today, the Bebe Jodel. The whole interior is varnished ply and spruce struts. Ribbed aluminium on rudder pedal is just visible and a pencil hangs on a piece of string. (*Photo: G. A. Cull.*)



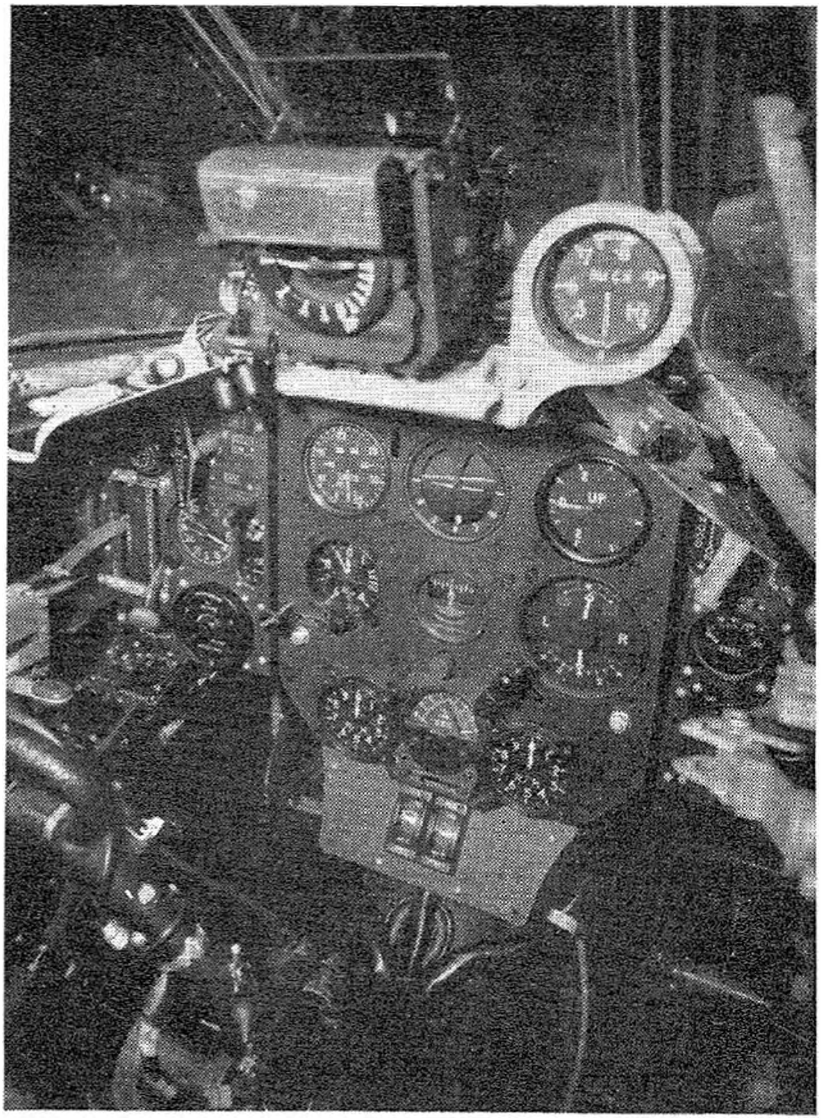
Instruments were sparse by today's standards and invariably had heavy, flanged brass rims. These gave a nautical air to the cockpit and this was heightened by the early type of Pioneer compass which was an elaborate brass instrument, usually in the middle of the dash, and is to be seen in the D.H.9A and Salamander cockpit photos. The Brisfit carried this gadget on the rear spar of the top centre section. Another instrument not seen in service machines nowadays was the cross level which may be described as a curved spirit-level. The handful of dials were A.S.I., rev counter, altimeter, coolant temperature, oil pressure, air pressure (fuel tank) and there was room in those days for a clock. If anything, rotary engined machines had even less in the way of instruments, this type of engine requiring only a rev counter and a pair of oil pulsator glasses in which the flow of oil could be seen. The magneto switches were the old electric light type with porcelain base and domed brass cover, and these endured into the '30's, *e.g.*, Bulldog. Engine controls consisted of throttle and fine-adjustment plus the "blip-switch" on top of the joystick. In World War I the pilot's seats were very small wicker bucket seats which ended in the small of the back. Joystick and rudder bar were often of ash and varnished.

Civil aircraft cockpits are tidier than those of service machines and in recent years have tended to follow modern car styling, particularly in America. Like cars, most light aircraft are available with upholstery in a choice of colours. The Autocrat, for example, may be had with red, green or neutral seat cushions and interior lining for the cabin, where none of the structure is to be seen excepting in the roof and under the instrument panel. In civil aircraft the Sutton safety harness is only fitted in aerobatic machines, and is normally replaced by the Mills safety belt or lap-strap. In all but the most modern instrument panels remain black and many instruments are common to both civil and military aircraft, but plastic knobs and chrome screws and fittings give a bright appearance and many dashboards have a cubby-hole, again, as in car practice. The Messenger and Gemini are good examples of this. Seats of all shapes and sizes are employed according to aircraft size, and four-seater cabin aircraft often have bench-type rear seats. With civil machines it is difficult to generalise, for their cockpits are largely individual in colour and, while they are all required by law to carry a rev counter, altimeter, A.S.I. and compass, and today even the humblest ultra-light does better than this, there are many instruments available as extras and blind flying instruments are optional. The all-important joystick is usually a plain tube with a flange about 6 in. from the top to prevent the hand slipping down. Spade grips (without gun button!) are, however, fitted to some machines, *e.g.*, Proctor. While much can be taken for granted in a service machine, civil cockpits vary a great deal and call for more detailed research if the model version is to be right.

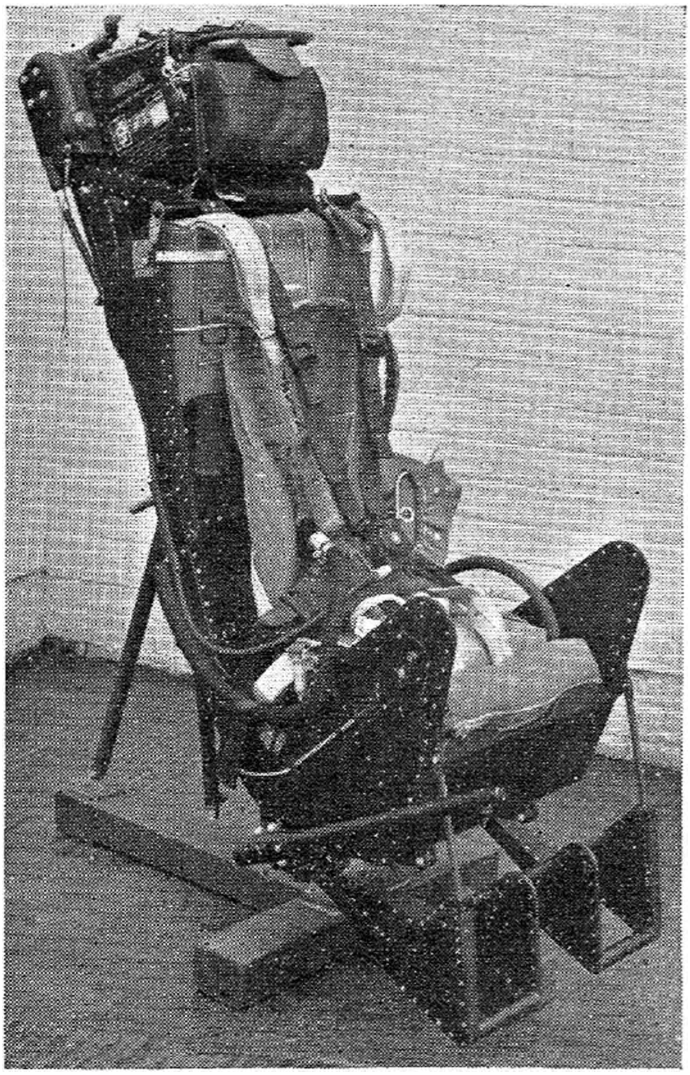
Modelling

The solid scale model made to delight the eye can hardly get away with an empty hole where the cockpit ought to be. Where the machine to be modelled has a framed cockpit cover, like the Hurricane, and the scale is 1/48 or smaller, a lot of detail would be wasted, particularly if a pilot is to be fitted, when little

Top left: The famous wartime Lancaster Bomber of Dam Busting fame. The Lancaster was slightly simpler than the Stirling which enjoyed the somewhat staggering total of one hundred and four "clocks" facing the pilot! (*Photo by courtesy of A. V. Roe, Ltd.*)



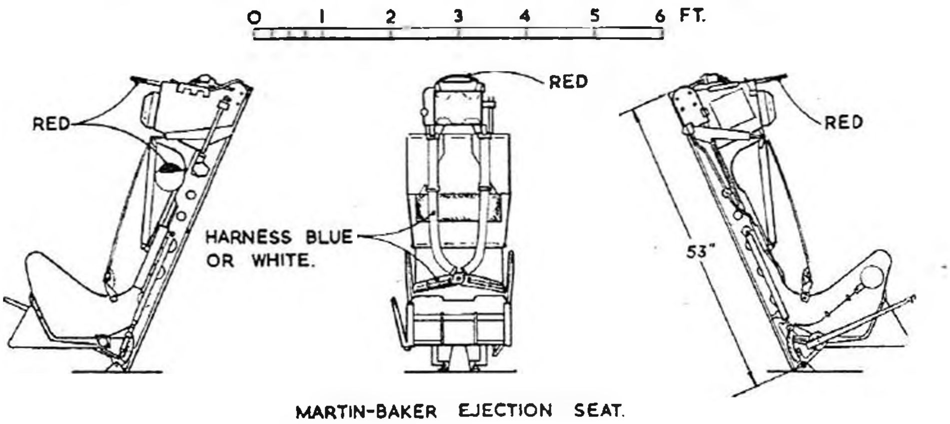
Right: The black cockpit of a Jet Fighter. Note the Machmeter of recent times placed near eye level, while the age-old spade-grip is still employed. Aircraft is a Meteor. (*Photo by courtesy of Gloster Aircraft, Ltd.*)



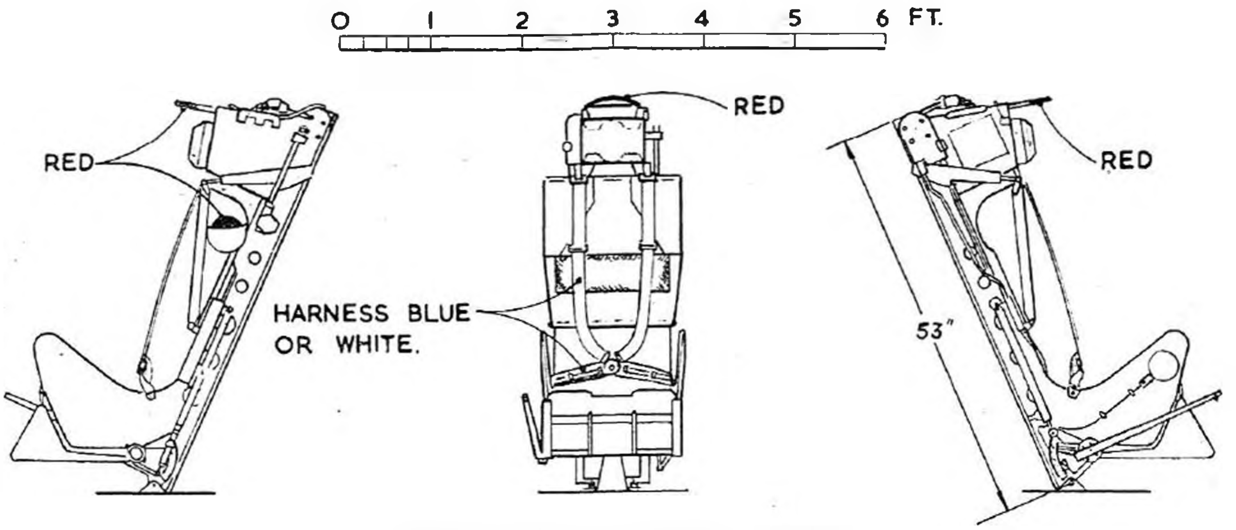
The jet has introduced this massive piece of cockpit furniture, the ejection seat. The foot rests at the bottom are adjustable and the whole is anodised black. Seat is shown complete with pilot's own parachute and harness. *(Photo by courtesy of Martin-Baker Aircraft Co.)*

below the pilot's shoulders would be discernible. An unframed cockpit hood, as on the Spitfire, and bubble type food reveal rather more, but with the pilot in place little more than stick, instrument panel and gunsight is needed. Without a pilot, more light can enter the cockpit and it pays to fit seat, harness, throttle, compass and some equipment on the cockpit walls. With an open cockpit, of course, there is no hood to screen any shortcomings, but let us take the modelling of a Hurricane cockpit as typical of the Battle of Britain period, popular with modellers, and much can also apply to the open cockpit Hart and Fury.

Cockpit work can start as soon as all fuselage shaping is finished and the slot for the wing cut out. The whole depth and width in the cockpit area must be thoroughly hollowed out and first step towards this is to cut away the section required for moulding the cockpit hood. Next the section above the top longeron is removed—the front edge of this is fixed by the first cowling join at, or forward, of the windscreen. The cut at the rear end of this section is made down the line of the pilot's headrest to the top longerons. As with the front one, the horizontal cut is made to coincide with a join on the real aircraft ascertained from drawing and photographs. A snag here,is to cut accurately along both sides of the fuselage with a piercing saw at the same time. Before using the saw, a lot can be done with

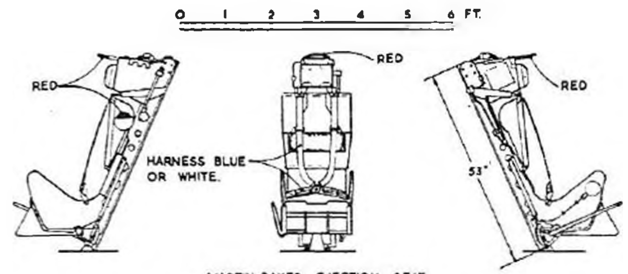


These authentic drawings of the Martin-Baker Ejection seat are given in three sizes to suit scale modellers, being respectively, 1/48th, 1/36th, and 1/72nd scale as reproduced on this and facing page.

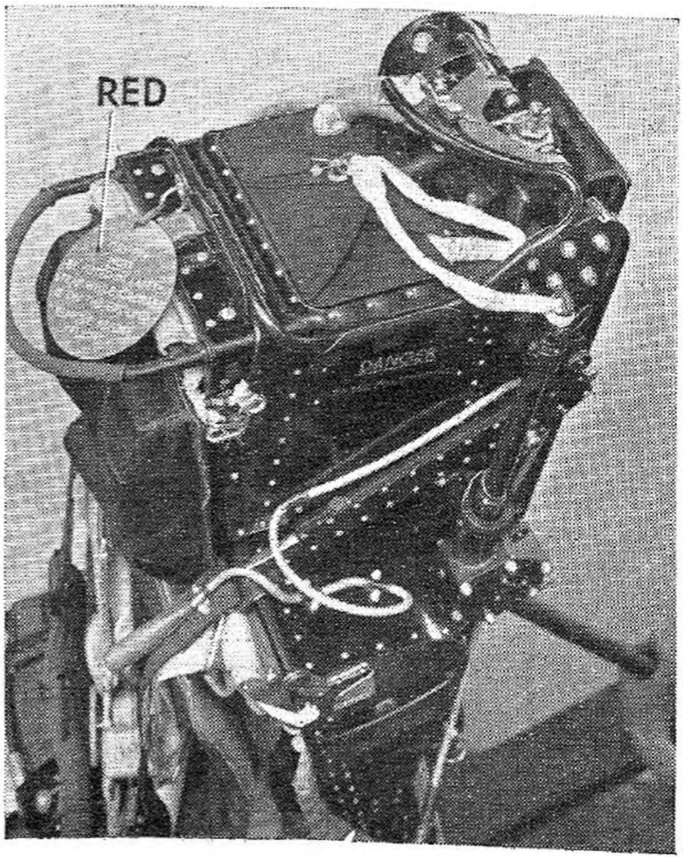


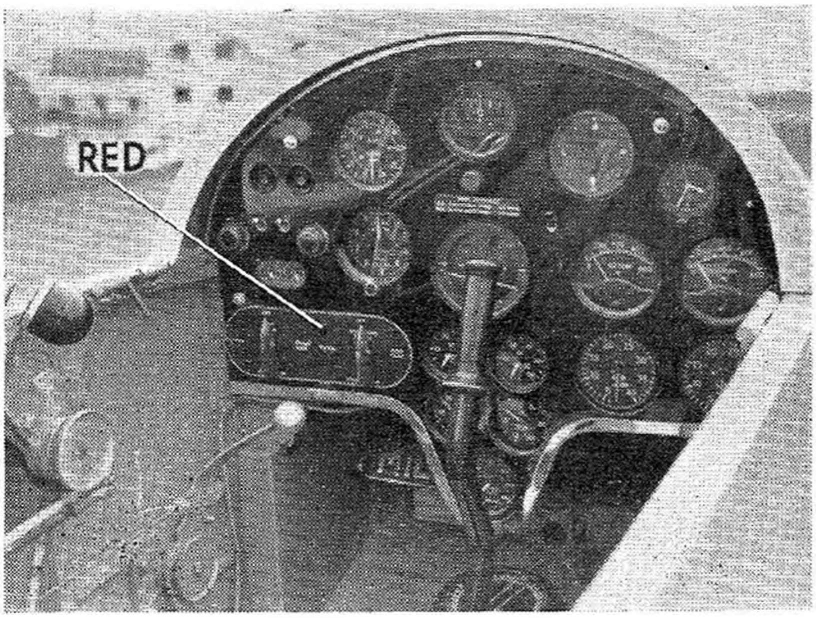
MARTIN-BAKER EJECTION SEAT.

a single-edged razor blade, working from both sides so that the saw has only to follow these cuts to part this section of decking from the fuselage. This section can now be carved out to a shell with walls about 3/64-in. thick. The fuselage now looks in a sorry state, but must be ruthlessly hollowed out leaving cockpit walls also 3/64-in. thick. To do this drill right through from top to bottom and finish with chisel and sandpaper, leaving nose and tail of fuselage connected by the two cockpit sides only—no bottom. Now the inside of the cockpit can be filled or else lined with good smooth-surfaced notepaper. At this stage a cockpit floor must be temporarily fitted for a biplane, but the top surface of the wing will serve for the Hurricane and need not yet be fixed. By constant fitting together of the fuselage and top decking the instrument panel outline can be found by carefully trimming a piece of card to fit. With this done, the final panel can be made on the hard-surfaced white card known as "Bristol Board." This calls for some careful work with Indian ink, ink bows or compasses and white ink. A tab



The bit that shows! The box-like top of the ejection seat which houses the parachute is easily seen through the cockpit hoods of modern fighters. In flight, the red disc is stowed in the pocket on the port side of the seat. (*Photo by courtesy of Martin-Baker Aircraft Co.*)

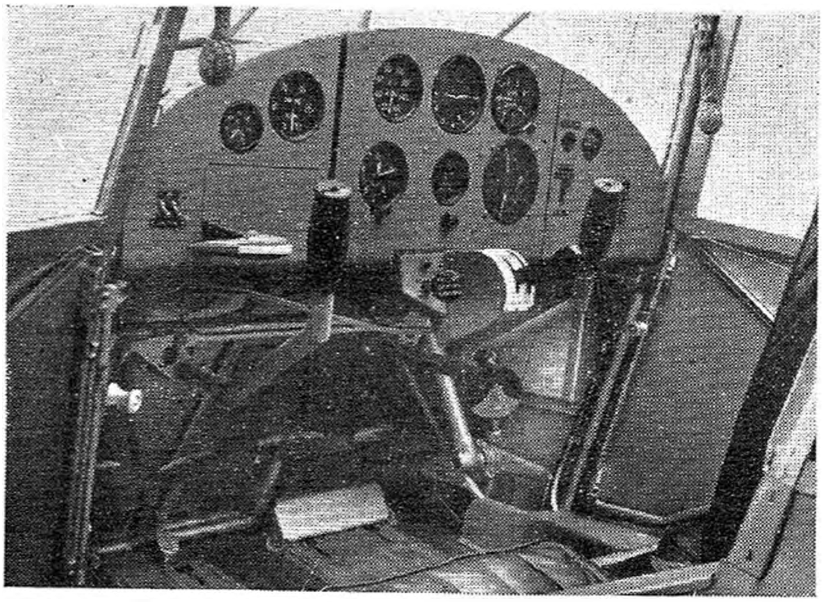




The cockpit of the Miles Sparrow-jet Racer is finished in medium grey. Note the chrome edge to the instrument panel. (*Aeroplane Photo.*)

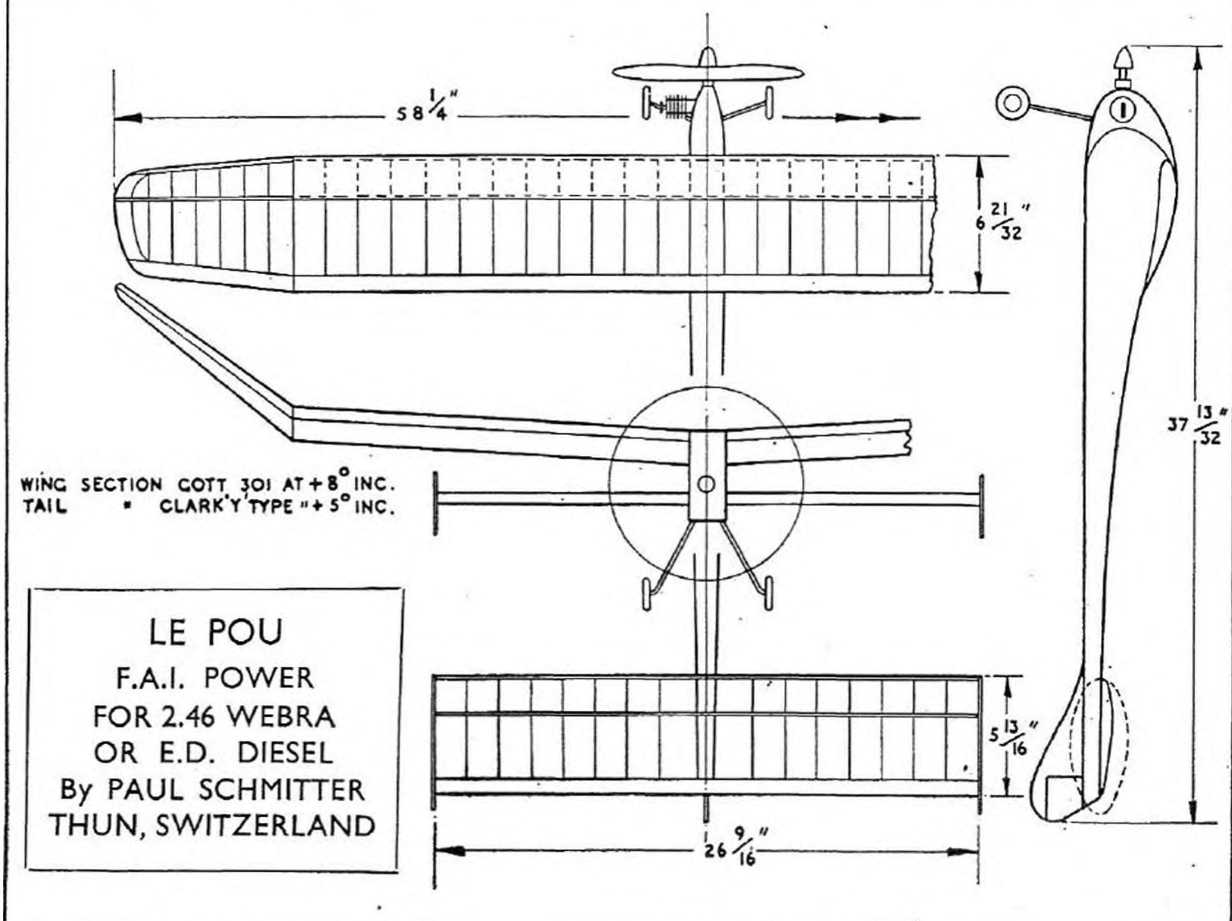
bent forward from the bottom of the panel will support the compass. Other parts that can now be made are the heel boards from aluminium foil and the joystick. Brass wire is good for this and the spade grip is closely bound with fuse wire. A spot of solder can be filed up to represent a gun button and a scrap of tinplate soldered on makes a brake lever. After the top of the wing is painted the joystick, heel boards and rudder bar formed from strip of tinplate or flattened brass wire, are mounted on the wing using tacky dope as adhesive. Best material for the seat is Celastoid moulded over the end of a stick with cross-section the same as the plan view of the seat and with the two longest sides radiused.

The moulding can be trimmed to shape on removal from the stick and will give a perfect surface for dope. Not being of stressed skin construction throughout, the Hurricane, biplane Fury, and Typhoon all have the tubular Warren girder structure visible in the cockpit and this is made in the same way that the fuselage sides of a flying model are built on the plan. Brass wire is used (18 and 20 s.w.g. for 1/48 scale) and this is pinned down over the plan except for the bottom longeron which is best made to fit the top of the wing (cockpit floor). With the two longerons and short diagonal struts in place on the plan, the whole can be soldered up and two of these sides will be required. After fitting these flush against the cockpit walls, where they will usually wedge in place, the cockpit interior, seat and top decking should be sprayed or painted cockpit green as thinly as possible—just enough to give the colour. The wing can next be glued permanently to the fuselage, taking care not to squeeze glue into the cockpit. Now for all the odds and ends on the cockpit walls. All levers, handles, etc., can be made from scraps of wire, pins and so on. Throttle, etc., can be pushed straight into the wood or else into small blocks of celastoid which can be stuck in place with cockpit green. For map-holders, ledges, brackets, fuse boxes and other mysterious objects and fittings, cellastoid (which can be easily filed) and Bristol Board (on which a pen can be used to good effect) are the things to use. The seat complete with paper harness straps can be stuck in place by its back or seat and so can the squab (painted brown). Turning to the separate top section, the instrument panel may be cemented in place by its edge, detail added to the walls and the compass (from dowel) put on its shelf. After a final touch up with black, grey, silver, yellow and red on the detail points in the cockpit already described, the top section can be glued back in its rightful place. Before filling the outside joins, lightly plug the cockpit with clean rag to exclude dust and the cockpit may now be forgotten until it is time to fit the gunsight and hood.



The Auster Aiglet Trainer has dual controls and this new civil aircraft has a crackle finish instrument panel. (*Photo by courtesy of Auster Aircraft. Ltd.*)

How to discover what a particular cockpit really looks like is the basic problem at the outset. The best scheme is to scan through all the magazines available and to write to the leading journals asking if they have any relevant photographs which may be purchased. The Imperial War Museum can often help. Should a very special model be envisaged to a scale where a great deal of effort is to be spent on cockpit detail, a request to the manufacturers may prove fruitful. Best of all is inspection of the actual machine, and this can sometimes be possible as a result of genuine enquiries, but ordinarily, a good job can be made of cockpits up to 1/24 scale without special information, and good enough to satisfy the pilot himself.



LE POU
F.A.I. POWER
FOR 2.46 WEBRA
OR E.D. DIESEL
By PAUL SCHMITTER
THUN, SWITZERLAND

WHY NOT KEEP A FLIGHT LOG?

A GOOD model is worth remembering, and it is surprising how fickle memory may be. Over the years you may find it difficult to recall more than the highlights of a particular model's career. More important still, a comparatively new model "rested" for a period may have to be trimmed all over again, because you have forgotten the amount of packing you used to use under the tailplane, even the number of strands in the rubber motor, or perhaps the amount of fin offset to give that perfect, spiralling climb.

You should keep a flight log for each model built. Then you will have a permanent record of its behaviour right through its career—a log to which you can refer for trimming data and one which will, many years later, make interesting reading and recall many pleasant memories.

The flight log itself need only be a very inexpensive item. It is, in fact, suggested that one be made up from ordinary notepaper, stapled to a thin card cover. Size is not very important. Make it relatively small—about 5.4 inch pages—so that it will go into the pocket. About twenty-four pages should be adequate to cover the average model's life.

A separate log should be made for *each* model. Regard it as a little job to be done to complete the model ready for flying. The log can then go with the model, travelling in the model-box with it, or kept in a suitable rack in your den if the model is "temporarily withdrawn" from service.

The following layout is suggested as the most convenient and most useful of laying out your log book. Page one, the front cover, should carry the name of the model and other leading data, such as span, areas, weight completed and in flying trim, etc. These are the more or less fixed data appropriate to the model. If you do change any later on, then amend the entry accordingly. Make a note also of the date of completing the model and the date of its first test flight.

Page two, the front inside cover, should contain trimming data, where it is always handy for reference. The type of data recorded here will vary according to the type of model. With rubber and power models, for instance, you will note side- and down-thrust settings, as established by trimming, other packing izes to trim, and so on. In the case of power models, note engine control settings (needle valve so many turns open, etc.).

Page three should then be devoted to flight characteristics. For example, some free flight models seem naturally to develop a spiral climb, others have a more open circle when trimmed out. Perhaps one particular model trims out best with wide circles on the climb and tighter circles on the glide. Note these characteristics down when you have completed trimming. Then if you come to fly the model again some long time after, you can check from the flight log what the flight characteristics should be.

The remaining pages of the log can then be devoted to recording actual flights—date, place, weather, etc., and performances achieved. Make these records as comprehensive as possible, without getting unwieldy. The value of having a separate log for each model will be particularly apparent here for you can lay out the entries to suit the various factors concerned with different types of models without any fear of confusion. Set the pages out in columns, spreading over two pages, similar to the following examples, ruling the columns and printing in the headings neatly.

RUBBER MODELS

Date	Place	Motor	Turns	Time	Remarks	Weather
12.6.54	Epsom Downs	16str.¼(A)	600 800	2 : 01 3 : 20	} TRIM CHECK	Calm, dull.
13.6.54	Chobham Common	16str. ¼(A)	700 850	2 : 58 3 : 49		Light S.W. wind Sunny.
		16str. ¼(B)	800	4 : 00	new motor	
				10 : 47	1st PLACE CLUB CONTEST	

The above table includes some typical entries, as an example of how you can keep a complete record with very little trouble. Think how interesting it will be to read back through those records at the end of the season!

Slightly different column headings are suggested for other types of models. The following list covers the remaining free flight and control line types.

FREE FLIGHT POWER

Date	Place	Fuel	Prop.	Motor run	Time	Remarks	Weather

GLIDER

Date	Place	Towline	Duration	Remarks	Weather

RADIO CONTROL

Date	Place	L/T bat.	H/T bat.	Servo battery	Special manoeuvres	Remarks

CONTROL LINE SPEED

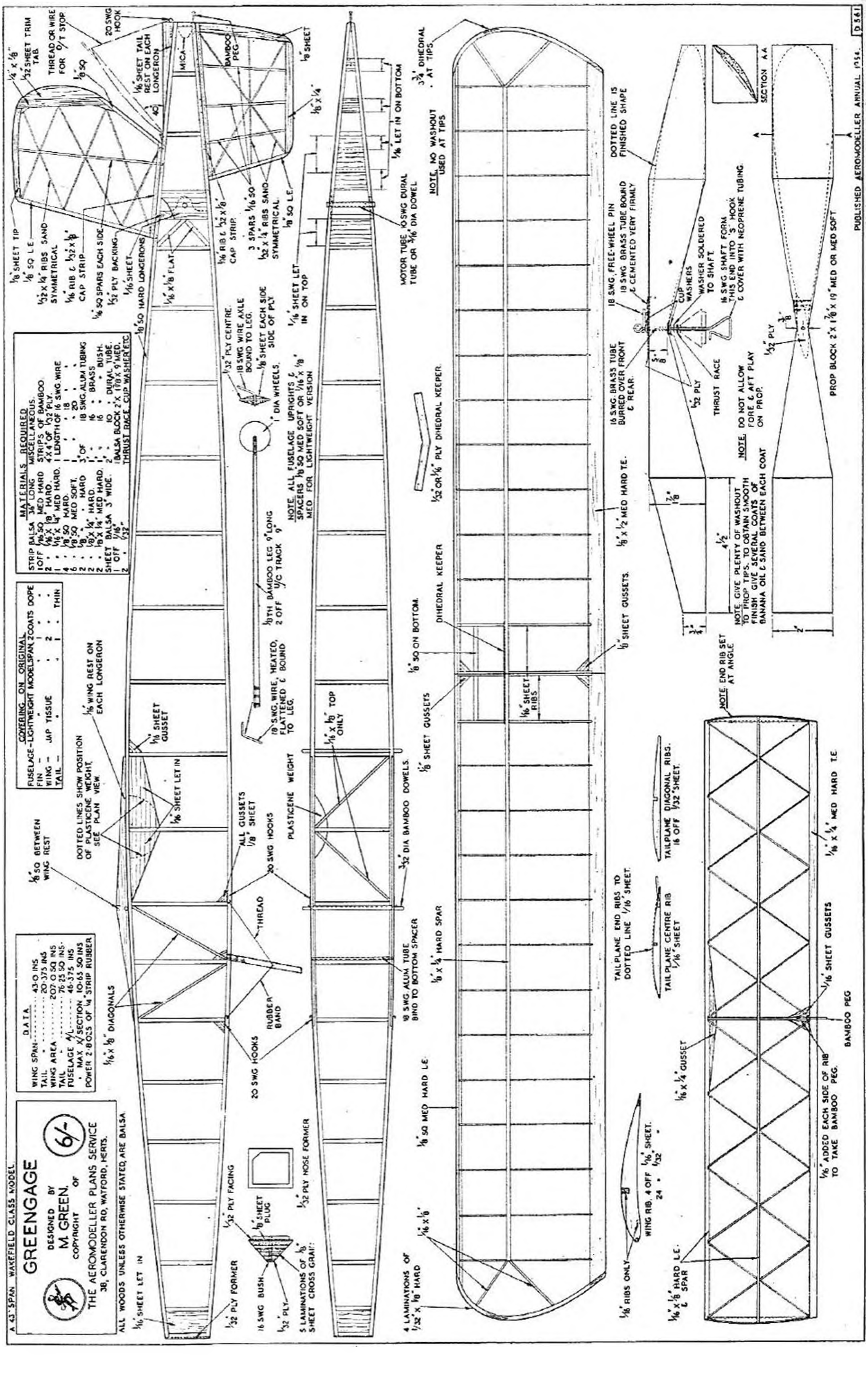
Date	Place	Fuel	Prop	Line length	Laps	Time	Speed	Remarks

CONTROL LINE AEROBATICS

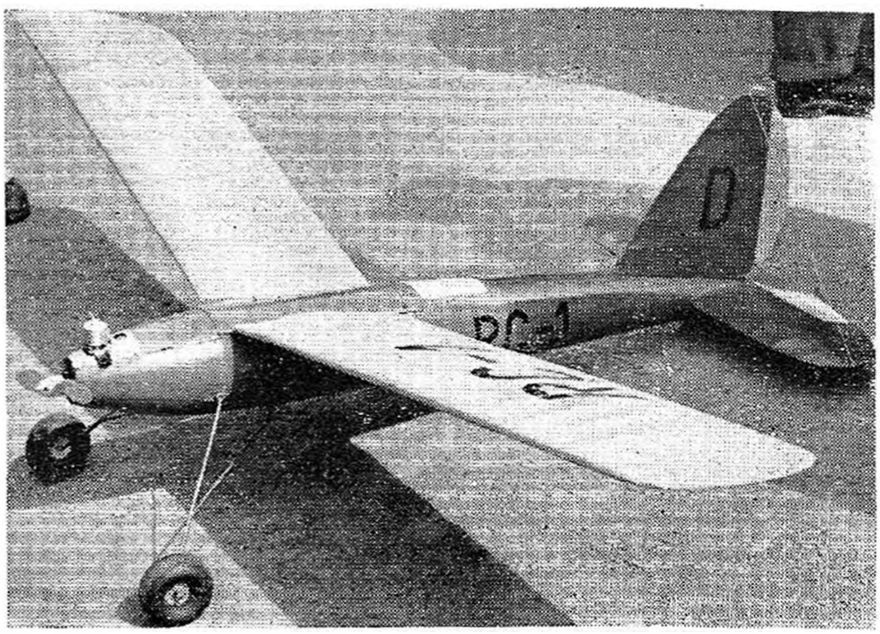
Date	Place	Fuel	Prop	Aerobatics	Remarks

CONTROL LINE TEAM RACER

Date	Place	Fuel	Prop	Distance	Time	Av. Speed	Remarks


A 43" SPAN WAKEFIELD CLASS MODEL
GREENGAGE
DESIGNED BY M. GREEN
COPYRIGHT OF THE AEROMODELLER PLANS SERVICE
38, CLARENDON RD, WATFORD, HERTS.
6/-
ALL WOODS UNLESS OTHERWISE STATED, ARE BALSA.
DATA
WING SPAN 43·0 INS
WING AREA 207·0 SQ INS
FUSELAGE A/L 48·375 INS
POWER 2·8OZS OF 1/4" STRIP RUBBER
COVERING ON ORIGINAL
FUSELAGE - LIGHTWEIGHT MODELSPAN, 2 COATS DOPE
WING - JAP TISSUE
MATERIALS REQUIRED
NOTE. NO WASHOUT USED AT TIPS
3/4" DIHEDRAL AT TIPS
DIHEDRAL KEEPER
1/8" SQ MED HARD L.E.
1/8" x 1/4" HARD SPAN
1/8" x 1/2" MED HARD T.E.
1/16" SHEET GUSSETS
1/16" SHEET RIBS
TAILPLANE CENTRE RIB 1/16" SHEET
TAILPLANE DIAGONAL RIBS 16 OFF 1/32" SHEET
BAMBOO PEG
PLASTICENE WEIGHT
RUBBER BAND
20 SWG HOOKS
THRUST RACE
CUP WASHERS
DOTTED LINE IS FINISHED SHAPE
SECTION AA
PROP BLOCK 2" x 1 7/8" x 19" MED OR MED SOFT
NOTE. DO NOT ALLOW FORE & AFT PLAY ON PROP.
NOTE. GIVE PLENTY OF WASHOUT TO PROP TIPS. TO OBTAIN SMOOTH FINISH GIVE SEVERAL COATS OF BANANA OIL & SAND BETWEEN EACH COAT
PUBLISHED AEROMODELLER ANNUAL 1954.
D 561

INTERNATIONAL RADIO CONTROL CONTEST, EVERE AERODROME, BRUSSELS



Right: Kurt Stegmaier's vacuum operated winner of the King of the Belgians' Cup—a triumph of engineering skill and piloting dexterity.
Below: The "beauty" of the meeting—Ragoni of Switzerland's twin boom model, that did not fly owing to damage in transit.

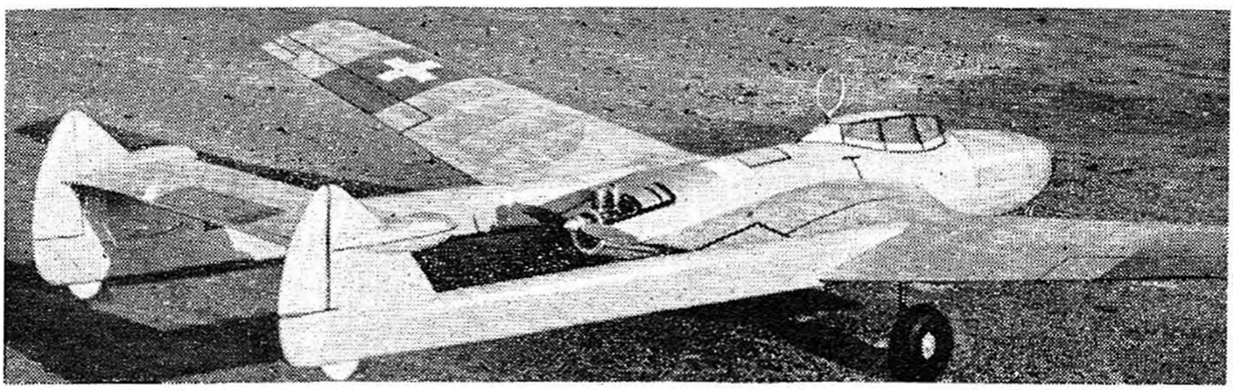
KING OF THE BELGIANS' CUP 1954

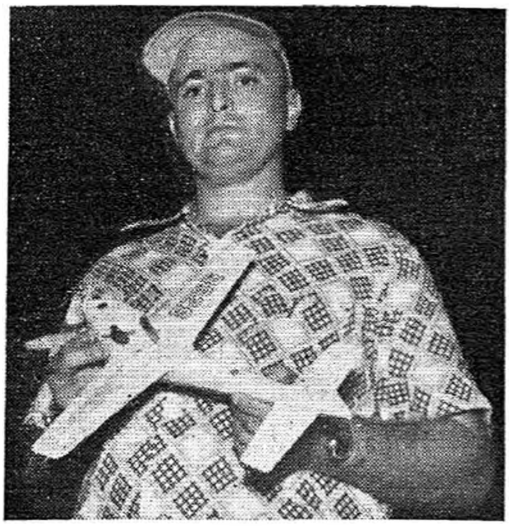
Placing	Name	Country	Points
1	Stegmaier, K.	Germany	624
2	Lichius, H.	,, ...	615
3	Gobeaux, J. P.	Belgium	471
4	De Hertog	,, ...	401
5	Hemsley, O. E.	Great Britain ..	353
6	Allen, S.	,, ...	333
7	Honnest-Redlich, G. ..	,, ...	119
8	Previnaire, A.	Belgium	103
9	Veenhoven	Holland	54
10	Wastable, A.	France	50

BELGIAN AERO CLUB CUP: GLIDERS

Placing	Name	Country	Points
1	Mabille	Belgium	304=
2	Millet, Dr.	France	302=
3	Meyer	Germany	119
4	Poulain	France	33

(= *Placed equal by F.A.I. Appeal Jury, pending regulation by C.I.A.M.*)





WORLD CONTROL LINE CHAMPIONSHIPS

THE HAGUE, HOLLAND, AUG. 20-22

TEAM RESULTS

1	Great Britain	11
2	Belgium	14
3	France	17
4	Holland	18
5	U.S.A.	19
6	Germany	23
7	Sweden	24
8	Switzerland	26

5 c.c. SPEED (1954 WORLD CHAMPIONSHIP CLASS)

Placing	*Contestant*	*Country*	*Speed (m.p.h.)*
1	Lutker, R.	U.S.A.	137.9
2	Ericsson, O.	Sweden	137.9
3	Labarde, R.	France	132.9
4	Desloges, J.	France	132.9
5	Frei, H.	Switzerland	124.8
6	Wright, P.	Gt. Britain	124.3
7	Dunn, B.	Gt. Britain	119.8
8	Soderberg, G.	Sweden	116.1
9	Janssens, J.	Belgium	114.9
10	Laniot, G.	France	106.25

2.5 c.c. SPEED

1	Wright, P.	Gt. Britain	111.8
2	Fresl, E.	Jugoslavia	104.4
3	Desloges, J.	France	97.5
4	Gordijn, M. J.	Holland	96.9
5	Smith, P.	Gt. Britain	96.25
6	Labarde, R.	France	95
7	Dunn, B.	Gt. Britain	94.3
8	Stouffs, H.	Belgium	90.7
9	Edmonds, R.	Gt. Britain	89.5
10	Laniot, G.	France	88.8

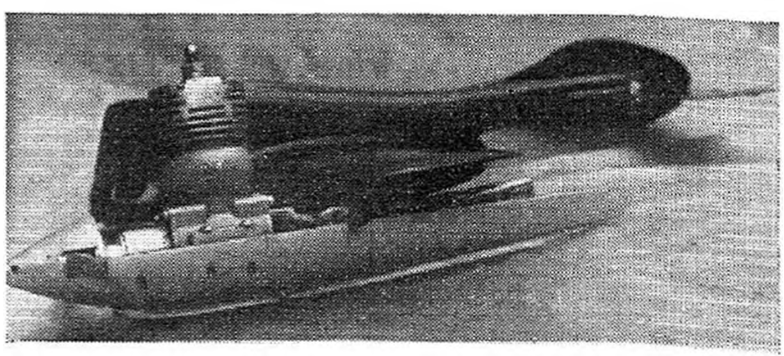
AEROBATICS

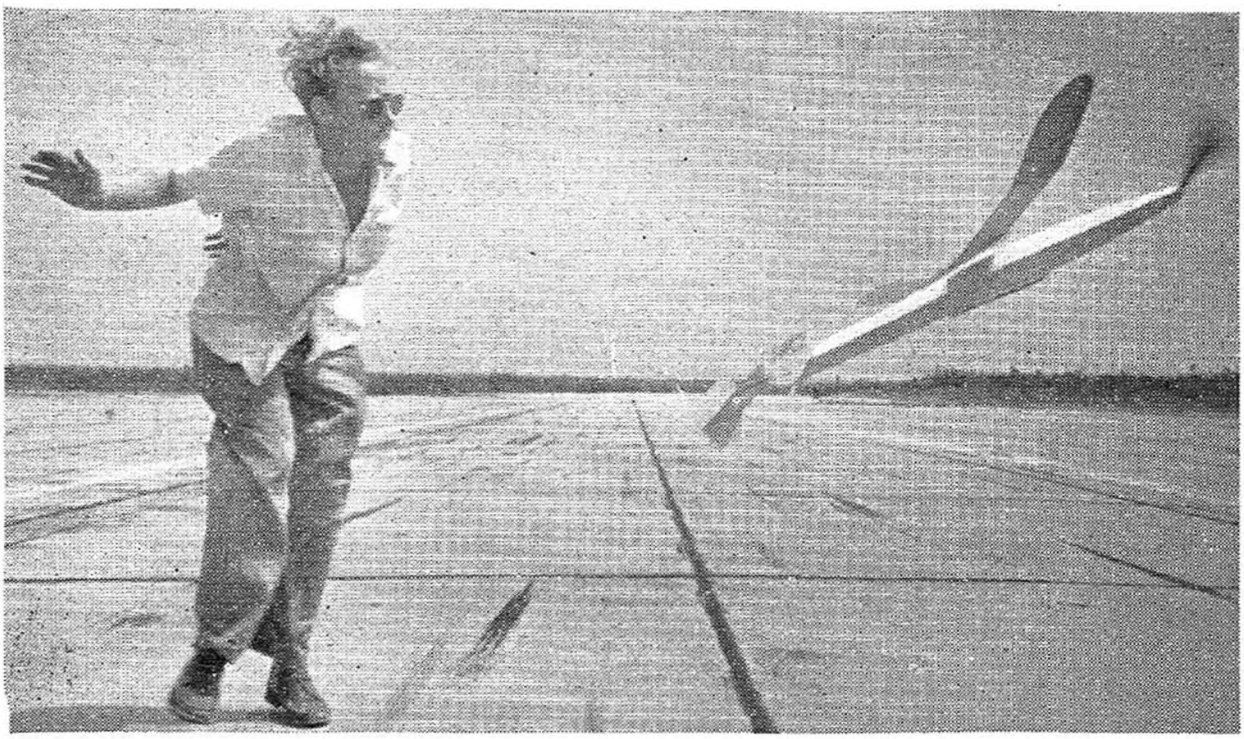
			Points
1	Stouffs, H.	Belgium	1279
2	Lutker, R.	U.S.A.	1276
3	Smith, P.	Gt. Britain	1212
4	Vallez, J-P.	Belgium	1201.2
5	Laniot, G.	France	1182.1

TEAM RACING (F.A.I. CLASS)

1 Smith, P. (Gt. Britain) 2 Janssens, J. (Belgium) 3 Edmonds, R. (Gt. Britain)

Above: Colourful Texan R. Lutker with his winning 5 c.c. model. He nearly made a double by coming within 3 points of stunt winner. *Right:* O. Ericsson of Sweden's Dooling powered 5 c.c. speed model, which equalled Lutker's best time, and came second on average.

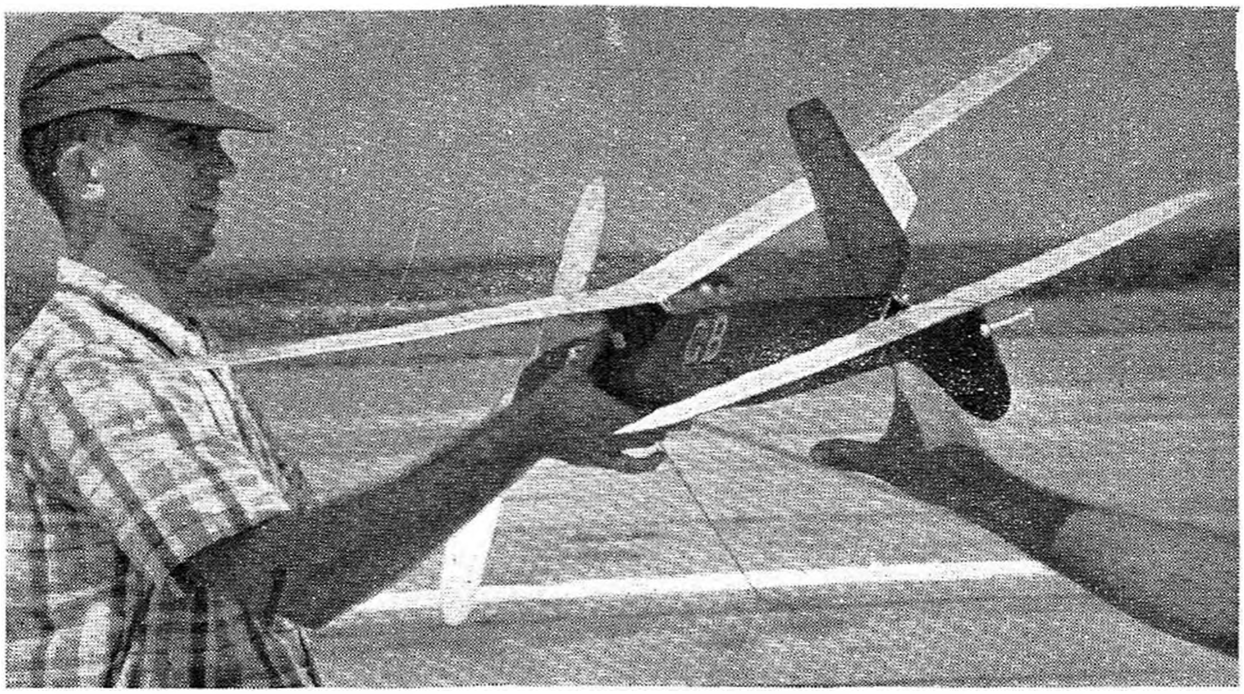




Alan King, first ever Australian Wakefield winner, in characteristic launching attitude. Alan is top flight power man too, taking 5th place in that event with his Flying Pencil, featured in Aeromodeller Annual, 1950. (*Photo: Berni Schoenfield, New York.*)

1954 INTERNATIONAL WAKEFIELD CONTEST

Placing	Contestant	Country and Proxy	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
1 ..	King, Alan	Australia ..	180	180	180	180	180	900
2 ..	Jackson, Charles ..	Great Britain (Carl Hermes)	146	180	180	180	180	866
3 ..	Lim Joon, Allan ..	Australia (Manuel Andrade)	180	143	180	180	180	863
4 ..	Upton, John	N. Zealand (George Reich)	180	180	180	124	180	844
5 ..	Dunham, Bob ..	U.S.A. ..	120	175	180	180	180	835
6 ..	Blomgren, Arne ..	Sweden ..	180	146	180	128	180	814
7 ..	Joyce, Philip	Canada ..	180	180	141	180	125	806
8 ..	Mursep, Fabi ..	Argentina ..	152	169	120	180	180	801
9 ..	Baxter, Dick	U.S.A. ..	180	180	177	180	81	798
10 ..	Gillespie, Warren ..	U.S.A. ..	123	138	180	180	150	771
11 ..	Rockell, William ..	Great Britain (Dick Quermann)	103	152	154	180	180	769
12 ..	Mayes, Cyril ..	Canada ..	180	180	141	79	180	760
13 ..	Ranta, Sorjo	Canada ..	102	180	180	114	180	756
14 ..	Hakansson, Anders	Sweden ..	118	180	147	180	126	751
15 ..	Wilson, Donald ..	N. Zealand (Edward Naudzius) ..	107	180	98	180	180	745
16 ..	DeBatty, Robert ..	U.S.A. ..	121	161	111	180	165	738



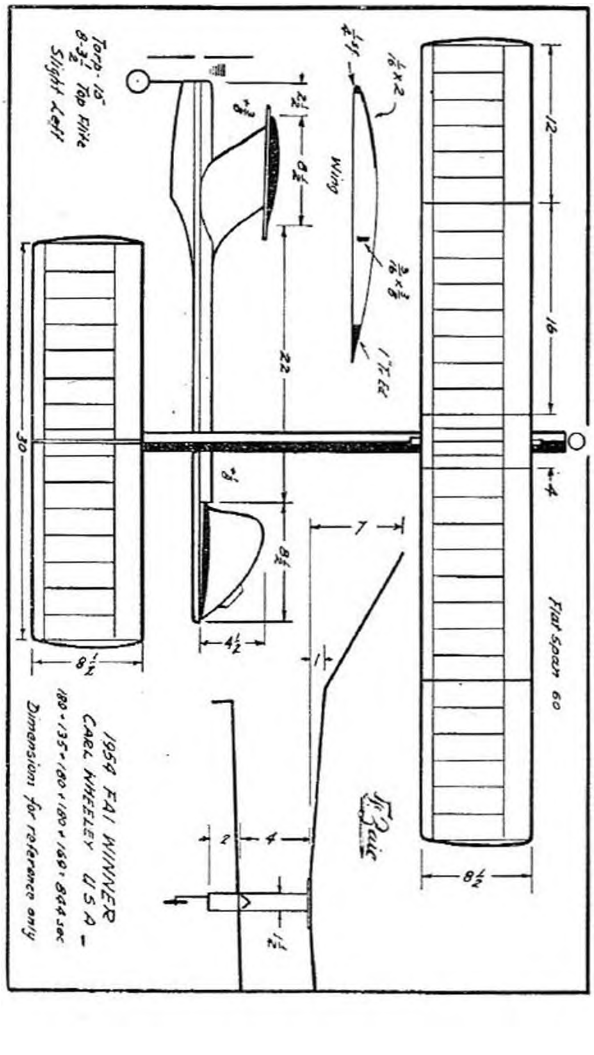
Carl Hermes, who came over to Cranfield to fly 31st in 1953, did better as proxy for Charles B. Jackson, Gt. Britain, whom he assisted to 2nd place, with a four out of five max. score. (*Photo: Berni Schoenfield, New York.*)

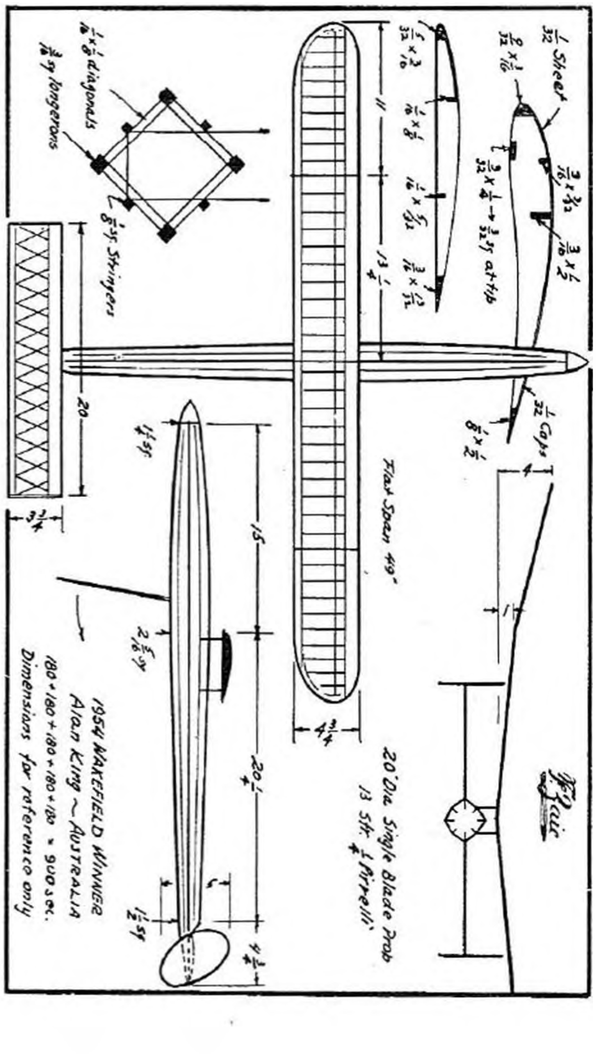
Placing	Contestant	Country	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
17 ..	Leong, Alfred ..	N. Zealand (Bob Hatschek)	107	180	84	180	180	731
18 ..	Bobkowski, Andy ..	Guatemala	112	101	131	180	180	704
19 ..	O'Donnell, Hugh ..	Great Britain (C. M. Montplaisir)	171	180	168	180	—	699
20 ..	Altamirano, Cesar ..	Argentina ..	157	180	180	—	180	697
21 ..	Benavidez, Eduaro ..	Argentina ..	140	180	180	180	—	680
22 ..	MacKenzie, Donald ..	Canada ..	154	95	129	117	180	675
23 ..	Dubery, Vic	Great Britain (Jerry Kolb)	128	157	180	95	73	633
24 ..	Pardo, Jose	Guatemala (L. Vargo)	42	53	180	142	180	597
25 ..	Miyoshi, Kiyotatsu	Japan ..	28	25	180	116	180	529
26 ..	Colombo, Ernesto ..	Argentina ..	77	70	180	88	—	415
27 ..	Macauley, F. A. ..	N. Zealand (Stan Colson)	51	—	158	40	—	249
28 ..	Pellecer, Oswaldo V.	Guatemala (Lee Renaud)	—	—	34	—	180	214

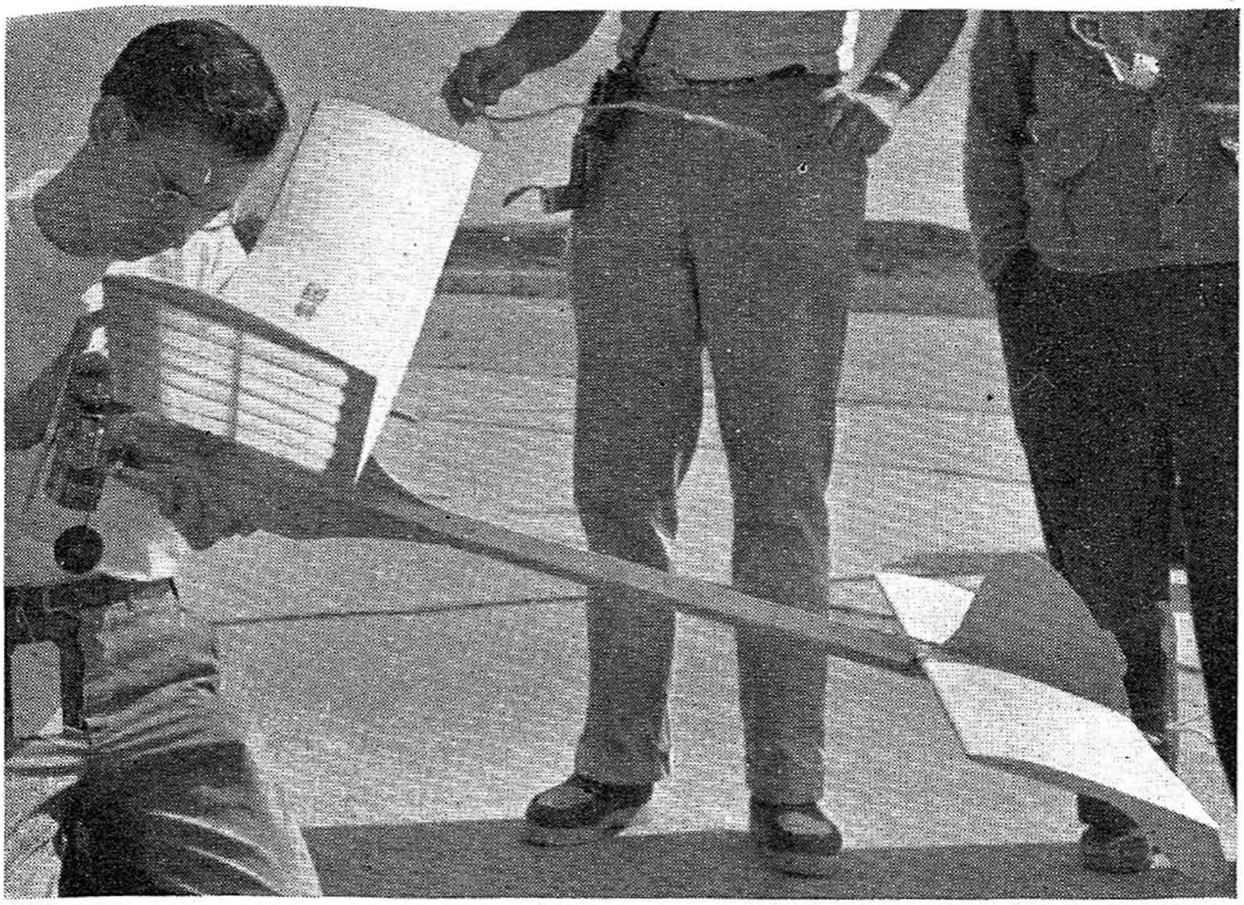
TEAM RESULTS

U.S.A.	2404
Great Britain ..	2334
Canada	2322
New Zealand ..	2320
Argentina	2178
Australia	1763
Sweden	1565
Guatemala	1511
Japan	529

Honourable Japanese Wakefield participant Kiyotatsu Miyoshi showed possibilities of his model with two maximums, but could not overcome handicap of a shaky start. (*Photo: Berni Schoenfield, New York.*)



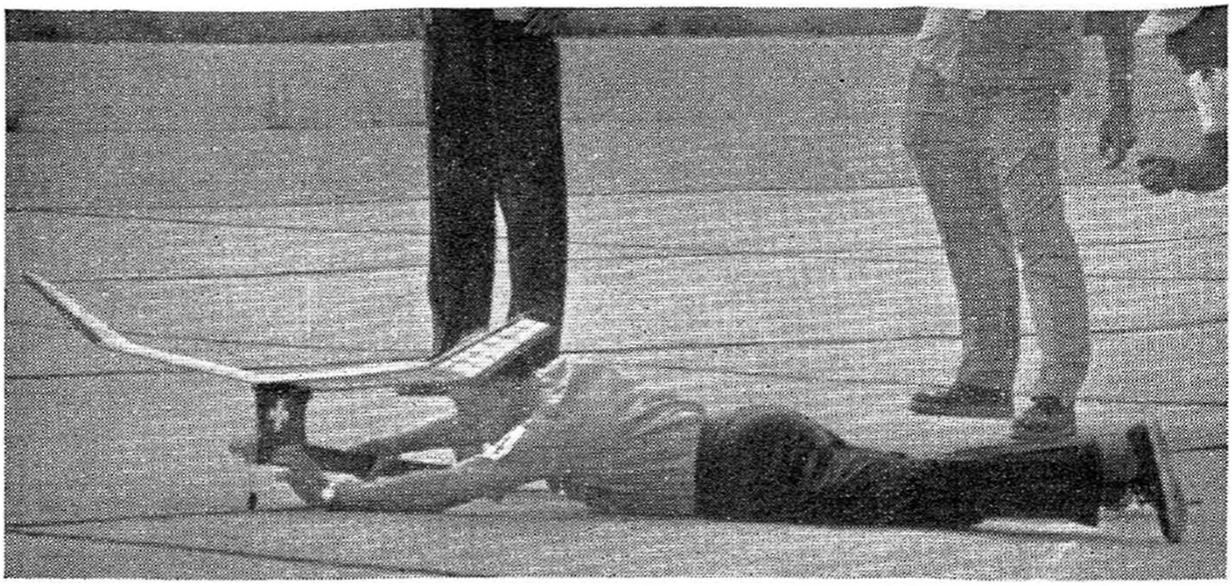




Carl Wheeley, 1954 World Power Champion, with his scaled up "Little Senator"—the same model that he flew into 18th place at Cranfield in 1953. Model still carries British penny taped to fuselage to make the weight. Engine is popular Torpedo 15, though model is considered somewhat large for this motor. *(Photo: Berni Schoenfield, NewYork.)*

1954 WORLD POWER CHAMPIONSHIPS FOR F.N.A.F.O.M. CUP

Placing	Contestant	Country and Proxy	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
1 ..	Wheeley, Carl ..	U.S.A. ..	180	135	180	180	169	844
2 ..	Lanfranchi, Silvio ..	Switzerland	180	118	180	173	180	831
3 ..	Kneeland, Dave ..	U.S.A. ..	180	180	142	180	101	783
4 ..	Gorham, John ..	Great Britain (Bill Dean) ..	180	180	119	180	64	723
5 ..	King, Alan	Australia ..	180	92	148	60	180	650
6 ..	Stajer, Francisco ..	Argentina ..	112	92	180	138	107	629
7 ..	Etherington, Bill ..	Canada ..	180	180	88	—	180	628
8 ..	Meduri, Jose ..	Argentina ..	47	151	180	94	130	602
9 ..	Hagel, Rolf	Sweden (Hakansson)	113	180	48	80	180	601
10 ..	Lastra, Oscar ..	Argentina ..	62	72	101	180	180	595
11 ..	Tatone, John	U.S.A. ..	102	180	—	115	180	577
12 ..	Lagermeier, Ray ..	U.S.A. ..	—	—	180	180	180	540
13 ..	Bousfield, Keith ..	Canada ..	180	180	—	26	65	451
14 ..	Upson, George ..	Great Britain (Parmenter)	105	—	—	125	180	410
15 ..	Quevedo, Julio ..	Guatemala	76	112	57	126	34	405
16 ..	Hillicoat, Federico ..	Argentina ..	34	54	69	68	169	394
17 ..	Mackenzie, Bob ..	Canada ..	51	33	180	51	75	390

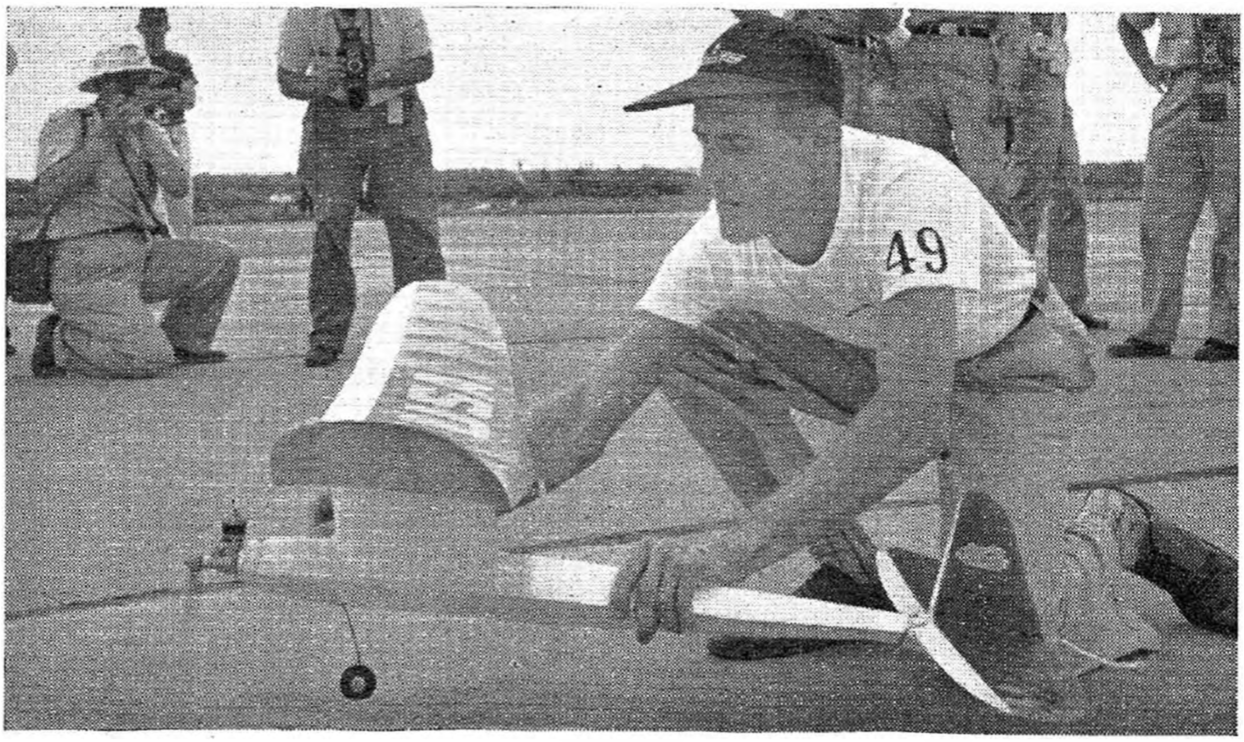


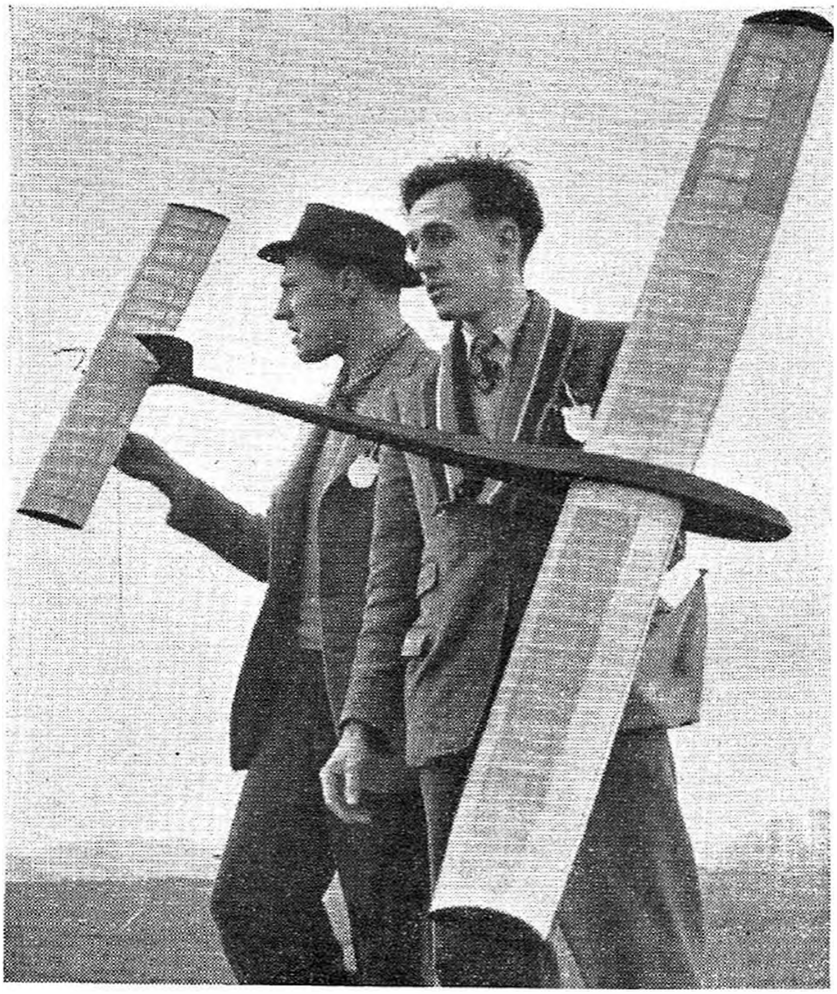
Silvio Lanfranchi gets down to it in typical fashion. He flew well to take 2nd place for Switzerland. *Below:* Unlucky Dave Kneeland with his Vapour Trails, 1953 winner, that came 3rd with a poor 5th flight after 4th round lead. (*Photo: Berni Schoenfield, New York.*)

Placing	Contestant	Country and Proxy	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
18 ..	DeCosio, Carlos ..	Mexico ..	88	180	—	—	—	268
19 ..	Graves, James ..	Canada ..	—	86	—	63	94	243
20 ..	Moulton, Ron ..	Great Britain (Joe Elgin) ..	120	—	48	—	—	168
21 ..	Buskell, Pete ..	Great Britain (Fran Hager)	—	—	—	—	—	—

TEAM PLACING

1	United States	2204	6	Australia	650
2	Argentina	1826	7	Sweden	601
3	Canada	1712	8	Guatemala	405
4	Great Britain	1301	9	Mexico	268
5	Switzerland	831			





SWEDISH GLIDER CUP WORLD MODEL GLIDER CHAMPIONSHIP

Held at Odense, Denmark, 1954

J. B. Hannay, on left, who came top in British A/2 trials could not do better than 15th at Odense. Model features endplates to both mainplane and stabiliser.

Placing	Contestant	Country	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
1 ..	Lindner, R.	Germany ..	145	31	180	30	180	566
2 ..	Rechenberg, I. ..	,, ..	87	105	106	66	180	544
3 ..	Luthersson, N. ..	Sweden ..	180	28	104	35	180	527
4 ..	Nironi, P.	Italy.. ..	46	180	90	59	140	515
5 ..	Weintraud, H. ..	Saar ..	88	63	47	180	128	506
6 ..	Niemela, S.	Finland ..	94	43	88	124	149	498
7 ..	Bartschi, W.	Switzerland	72	116	45	77	180	490
8 ..	Thomann, H. ..	,, ..	180	68	20	180	40	488
9 ..	Knoll, R.	Saar ..	106	74	99	140	67	486
10 ..	Nesic, L.	Yugoslavia	55	61	133	136	90	475
11 ..	Hacklinger, M. ..	Germany ..	69	105	180	80	40	474
12 ..	Wheatley, J. J. ..	Great Britain	45	21	135	180	86	467
13 ..	Loo, J. E.	Netherlands	62	88	170	56	86	462
14 ..	Molbach, T.	Norway ..	54	78	75	180	66	453
15 ..	Hannay, J. B. ..	Great Britain	0	40	55	173	180	448
16 ..	Pedersen, S.	Denmark ..	72	72	75	180	47	446
17 ..	Templier, J. P. ..	France ..	25	87	180	76	66	434
18 ..	Ben-Shahar, Z. ..	Israel ..	62	118	32	78	137	427
19 ..	Lefort, P.	France ..	72	32	180	90	53	427
20 ..	de Graaf, J. G. ..	Netherlands	110	143	47	49	77	426
21 ..	Persson, L.	Sweden ..	76	65	90	94	100	425
22 ..	Hansen, Borge ..	Denmark ..	109	88	90	79	57	423
23 ..	Etherington, W. ..	Canada ..	79	39	90	180	23	411
24 ..	Gordon, R.	,, ..	96	129	0	45	130	400
25 ..	Dore, H. A.	U.S.A. ..	40	50	90	180	37	397

Placing	Contestant	Country	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
26 ..	Hauenstein, W. ..	Switzerland	99	38	77	112	70	396
27 ..	Ericsson, K.	Sweden ..	112	54	45	81	103	395
28 ..	Girak, H.	Austria ..	85	49	180	55	21	390
29 ..	Zidek, F.	,, ..	66	117	68	93	43	387
30 ..	Pouliquen, J.	France ..	53	90	71	67	103	384
31 ..	Juen, A.	Saar ..	35	81	142	0	113	371
32 ..	Jarvi, J.	Finland ..	37	149	84	39	58	367
33 ..	Delhalle, L.	Belgium ..	100	25	180	59	0	364
34 ..	Nielsen, H. F. ..	Denmark ..	61	46	66	120	55	348
35 ..	Maes, H.	Belgium ..	46	50	63	90	91	340
36 ..	Schonborn, W. ..	Saar ..	66	75	41	36	101	319
37 ..	Lock, J.	France ..	107	74	135	0	0	316
38 ..	Iotti, S.	Italy.. ..	74	118	0	79	41	312
39 ..	Haug, E.	Norway ..	102	62	49	59	40	312
40 ..	Bodmer, M.	Switzerland	63	56	137	56	0	312
41 ..	Kadmon, N.	Israel ..	79	43	52	92	43	309
42 ..	Hansen, H.	Denmark ..	72	34	54	58	90	308
43 ..	Boscarol, C.	Italy.. ..	87	60	56	61	43	307
44 ..	Federici, G.	,, ..	85	77	30	31	81	304
45 ..	Nilsson, P. F... ..	Sweden ..	24	36	79	30	127	296
46 ..	North, R. J.	Great Britain	49	58	36	97	41	281
47 ..	Klaasesz, R.	Netherland	74	72	52	35	48	281

TEAM CONTEST

1	Germany ..	1584
2	Switzerland	1374
3	Saar ..	1363
4	Sweden ..	1347
5	France ..	1245
6	Denmark ..	1217
7	Great Britain	1196
8	Netherlands	1169
9	Italy ..	1134
10	Finland ..	1120
11	Canada ..	1064
12	Austria ..	1026
13	Norway ..	1007
14	Belgium ..	949
15	U.S.A. ..	889
16	Yugoslavia ..	857
17	Israel ..	847
18	Monaco ..	564

Jack North came second in trials with this 1950 sparless A/2, which has 1in. rib spacing typical of such pastmasters as Chasteneuf, with whom he was fellow clubman in pre-war days.

Placing	Contestant	Country	1st Flt.	2nd Flt.	3rd Flt.	4th Flt.	5th Flt.	Total
48 ..	Huthinen, P.	Finland ..	112	0	0	0	143	255
49 ..	Crawford, J.	Canada ..	56	32	46	65	54	253
50 ..	Perryman, G.	U.S.A. ..	63	0	52	32	105	252
51 ..	Glavitsch, J.	Austria ..	49	53	0	93	54	249
52 ..	Aubertin, C.	Monaco ..	51	37	55	103	0	246
53 ..	Overlaet, G.	Belgium ..	45	55	27	60	58	245
54 ..	Riemer, W.	Germany ..	69	57	32	39	46	243
55 ..	Tonnesen, U. ..	Norway ..	52	63	25	48	54	242
56 ..	Hahn, C.	U.S.A. ..	114	20	37	26	43	240
57 ..	Bausch, L.	Netherlands	82	29	49	0	71	231
58 ..	Urbanek, F.	Austria ..	50	50	22	40	64	226
59 ..	Dupuits, P. F. ..	Monaco ..	0	78	27	56	48	209
60 ..	Pelikan, Z.	Yugoslavia	22	32	0	44	98	196
61 ..	John, E. J.	Great Britain	79	0	23	61	29	192
62 ..	Maringer, M. ..	Yugoslavia	0	27	74	42	43	186
63 ..	Harris, J.	U.S.A. ..	0	44	82	0	51	177
64 ..	Levi, R.	Israel ..	39	0	72	0	0	111
65 ..	Rantala, U.	Finland ..	41	36	33	0	0	110
66 ..	Aubertin, R.	Monaco ..	0	79	0	0	30	109
67 ..	Feron, L.	Belgium ..	100	0	0	0	0	100
68 ..	Saeter, P. E.	Norway ..	25	0	0	0	0	25
69 ..	Novaro, H.	Monaco ..	0	0	0	0	0	0
70 ..	Gunic, B.	Yugoslavia	0	0	0	0	0	0
71 ..	Adamski, V.	Belgium ..	0	0	0	0	0	0

PAST INTERNATIONAL TROPHY WINNERS

WAKEFIELD TROPHY

1928	Newell, T. H.	Gt. Britain
1929	Bullock, R. N.	Gt. Britain
1930	Ehrhardt, J. H.	U.S.A.
1931	Ehrhardt, J. H.	U.S.A.
1932	CONTEST VOID	
1933	Kenworthy, J. W.	Gt. Britain
1934	Allman, J. B.	Gt. Britain
1935	Light, G.	U.S.A.
1936	Judge, A. A.	Gt. Britain
1937	Fillon, E.	France
1938	Cahill, J.	U.S.A.
1939	Korda, R.	U.S.A.
1948	Chesterton, R.	Gt. Britain
1949	Ellila, A.	Finland
1950	Ellila, A.	Finland
1951	Stark, S.	Sweden
1952	Blomgren, A.	Sweden
1953	Foster, J.	U.S.A.
1954	King, A.	Australia

A/2 SWEDISH GLIDER CUP

1950	Bernfest, S.	Yugoslavia
1951	Czepa, O.	Austria
1952	Gunic, B.	Yugoslavia
1953	Hansen, H.	Denmark
1954	Lindner, R.	Germany

F.N.A.F.O.M. POWER CHAMPIONSHIP CUP

1951	Schmid, G.	Switzerland
1952	Wheeler, B.	Gt. Britain
1953	Kneeland, D.	U.S.A.
1954	Wheeley, C.	U.S.A.

List of British National Model Aircraft Records

31st August, 1954

Rubber Driven				
Monoplane	Boxall, F. H.	(Brighton)	15/ 5/1949	35 : 00
Biplane	Young, J. O.	(Harrow)	9/ 6/1940	31 : 05
Wakefield	Boxall, F. H.	(Brighton)	15/ 5/1949	35 : 00
Canard	Harrison, G. H.	(Hull Pegasus)	23/ 3/1952	6 : 12
Scale	Marcus, N. G.	(Croydon)	18/ 8/1946	5 : 22
Tailless...	Woolis, G. A. T.	(Bristol & West)	10/ 5/1953	3 : 03
Helicopter	Tangney, J. F.	(Croydon & U.S.A.)	2/ 7/1950	2 : 44
Rotorplane	Crow, S. R.	(Blackheath)	23/ 3/1936	: 40
Floatplane	Parham, R. T.	(Worcester)	27/ 7/1947	8 : 55
Flying Boat	Parker, R. A.	(Kentish Nomads)	24/ 8/1952	1 : 05
Ornithopter	White, J. S.	(Barking)	20/ 6/1954	1 : 55
Sailplane				
Tow Launch	Allsop, J.	(St. Albans)	11/ 4/1954	90 : 30
Hand Launch	Campbell-Kelly, G.	(Sutton Coldfield)	29/ 7/1951	24 : 30
Tailless (T.L.) ...	Lucas, A. R.	(Port Talbot)	21/ 8/1950	22 : 34
Tailless (H.L.) ...	Wilde, H. F.	(Chester)	4/ 9/1949	3 : 17
A/2 (T.L.)	Allsop, J.	(St. Albans)	11/ 4/1954	90 : 30
A/2 (H.L.)	Campbell-Kelly, G.	(Sutton Coldfield)	29/ 7/1951	24 : 30
Power Driven				
Class A...	Springham, H. E.	(Saffron Walden)	12/ 6/1949	25 : 01
Class B...	Dallaway, W. E.	(Birmingham)	17/ 4/1949	20 : 28
Class C...	Gaster, M.	(C/Member)	15/ 7/1951	10 : 44
Tailless...	Fisher, O. F. W.	(I.R.C.M.S.)	21/ 3/1954	4 : 12
Scale	Tinker, W. T.	(Ewell)	1/ 1/1950	3 : 37
Floatplane	Lucas, I. C.	(Brighton)	11/10/1953	4 : 58
Flying Boat	Gregory, N.	(Harrow)	18/10/1947	2 : 09
Radio Control ...	Pike, G. D.	(Foresters)	11/ 7/1954	100 : 35 *
				m.p.h.
Class I Speed	Wright, P.	(St. Albans)	7/ 6/1954	111.28
Class II Speed ...	Powell, D. R.	(East London)	7/ 6/1954	132.7
Class III Speed ...	Davenport, R. F.	(East London)	11/ 7/1954	152.17*
Class IV Jet	Stovold, R. V.	(Guildford)	25/ 9/1949	133.3

INDOOR

Stick (H.L.)	Parham, R. T.	(Worcester)	7/ 8/1954	21 : 12 *
Stick (R.O.G.) ...	Copland, R.	(Northern Heights)	8/ 8/1954	14 : 22 *
Fuselage (H.L.) ...	Parham, R. T.	(Worcester)	18/ 8/1951	7 : 15
Fuselage (R.O.G.) ...	Parham, R. T.	(Worcester)	18/ 8/1951	7 : 30
Tailless (H.L.) ...	Parham, R. T.	(Worcester)	18/ 8/1951	2 : 59
Tailless (R.O.G.) ...	Parham, R. T.	(Worcester)	18/ 8/1951	2 : 28
Ornithopter (H.L.) ...	Parham, R. T.	(Worcester)	9/ 1/1954	1 : 10
Helicopter (R.O.G.) ...	Parham, R. T.	(Worcester)	23/ 1/1954	4 : 28
Rotorplane	Parham, R. T.	(Worcester)	23/ 1/1954	0 : 40
R.T.P. Class A ...	Muxlow, E. C.	(Sheffield)	10/12/1948	6 : 05
R.T.P. Class B ...	Parham, R. T.	(Worcester)	20/ 3/1948	4 : 26
R.T.P. Speed ...	Jolley, T. A.	(Warrington)	19/ 2/1950	42.83 m.p.h.

OUTDOOR (Lightweight)

Rubber Driven				
Monoplane	Denison, W. J.	(Wakefield)	23/ 5/1954	27 : 59
Biplane	O'Donnell, J.	(Whitefield)	18/ 5/1952	6 : 46
Canard	Lake, R. T.	(Surbiton)	7/ 4/1954	7 : 32
Scale	Dubery, V. R.	(Leeds)	14/ 7/1951	1 : 11
Floatplane	Taylor, P. T.	(Thomes Valley)	24/ 8/1952	5 : 15
Flying Boat	Rainer, M.	(North Kent)	28/ 6/1947	1 : 09
Sailplane				
Tow Launch	Green, D.	(Oakington)	11/ 4/1954	36 : 02
Hand Launch	Redfern, S.	(Chester)	11/ 7/1954	11 : 15 *
Tailless (T.L.) ...	Couling, N. F.	(Sevenoaks)	3/ 6/1951	22 : 22
Tailless (H.L.) ...	Wilde, H. F.	(Chester)	11/ 7/1954	9 : 51 *
Canard (T.L.) ...	Caple, G.	(R.A.F. M.A.A.)	7/ 9/1952	22 : 11
Power Driven				
Class A...	Archer, W.	(Cheadle)	2/ 7/1950	31 : 05
Class C...	Ward, R. A.	(Croydon)	25/ 6/1950	5 : 33
Tailless...	Fisher, O. F. W.	(I.R.C.M.S.)	27/ 7/1954	3 : 02
Seaplane	Mussell, A.	(Brighton)	11/10/1953	2 : 53

(* *Ratification pending.*)

World and International Records

ABSOLUTE WORLD RECORDS

Duration	Koulakovsky, Igor	U.S.S.R.	6/ 8/1952			6 hr. 1 min.
Distance	Boricevitch, E.	U.S.S.R.	14/ 8/1952			378.756 km.
Altitude	Lioubouchkine, G.	U.S.S.R.	13/ 8/1947			4,152 m.
Speed (Straight)	Stiles, E.	U.S.A.	20/ 7/1949			129,768 km.
Speed (Circular)	Vassiltchenko, M.	U.S.S.R.	9/ 1/1953			264.7 km.

RUBBER DRIVEN

Duration				hr.	min.	sec.
Orthodox	Kiraly, M.	Hungary	20/ 8/1951	1	27	17
Seaplane	Egorovskaya, Mlle. I.	U.S.S.R.	21/ 7/1951	1	13	26
Special	Evergary, G.	Hungary	13/ 6/1950		7	43
Tailless...	Kiraly, M.	Hungary	23/ 8/1950		35	42
Tailless Seaplane	Kiraly, M.	Hungary	9/ 8/1952		3	42
Distance				km.		metre
Orthodox	Benedek, G.	Hungary	20/ 8/1947	50.26		
Seaplane	Horvath, E.	Hungary	10/ 9/1949	45.15		
Special	Roser, N.	Hungary	9/ 4/1950			238
Tailless...	Halla, J.	Hungary	2/ 9/1951	5.25		
Tailless Seaplane	Abaffy, E.	Hungary	10/ 7/1949			435
Altitude						
Orthodox	Poich, R.	Hungary	31/ 8/1948			1,442
Seaplane	Gasko,M.	Hungary	18/ 8/1949			939
Speed						km/h.
Orthodox	Davidov, V.	U.S.S.R.	11/ 7/1940			107.08
Seaplane	Abramov, B.	U.S.S.R.	6/ 8/1940			76.896
Tailless...	Koumanine, V.	U.S.S.R.	8/ 6/1953			90
Tailless Seaplane	Koumanine, V.	U.S.S.R.	8/ 8/1952			69.23

POWER DRIVEN

Duration				hr.	min.	sec.
Orthodox	Koulakovsky, I.	U.S.S.R.	6/ 8/1952	6	1	0
Seaplane	Batourlov, N.	U.S.S.R.	8/ 8/1952	4	18	20
Special ...	Khoukra, Y.	U.S.S.R.	18/ 8/1950		27	35
Tailless...	Lipinsky, L.	U.S.S.R.	14/ 8/1951	3	31	0
Tailless Seaplane	Koupfer, M.	U.S.S.R.	9/ 7/1953		41	17
Distance						km.
Orthodox	Boricevitch, E.	U.S.S.R.	14/ 8/1952			378.756
Seaplane	Koutcherov, E.	U.S.S.R.	14/ 8/1951			130.597
Special ...	Morozov, V.	U.S.S.R.	26/ 7/1952			22.4
Tailless...	Lipinsky, L.	U.S.S.R.	14/ 8/1951			109.282
Tailless Seaplane	Koupfer, M.	U.S.S.R.	9/ 7/1953			62.2
Altitude						metres
Orthodox	Lioubouchkine, G.	U.S.S.R.	13/ 8/1947			4,152
Seaplane	Kavsadze, I.	U.S.S.R.	8/ 8/1940			4,110
Tailless...	Lipinsky, L.	U.S.S.R.	14/ 8/1951			2,813
Tailless Seaplane	Koupfer, M.	U.S.S.R.	9/ 7/1953			1,997
Speed (Straight)						km/h.
Orthodox	Stiles, E.	U.S.A.	20/ 7/1949			129.768
Seaplane	Khabarov, R.	U.S.S.R.	18/ 8/1948			50.05
Tailless...	Koutcherov, E.	U.S.S.R.	14/ 6/1953			58
Speed (Circular) Class I						
Orthodox	Prati, A.	Italy	6/ 6/1954			190.47
Seaplane	Vassilchenko, V.	U.S.S.R.	28/ 5/1953			102.3
Special ...	Franko, J.	Hungary	2/11/1952			10.95
Tailless...	Marcenado, F.	Italy	17/ 5/1953			124.5
Speed (Circular) Class II						
Orthodox	Mueller, G. & Brown, M.	U.S.A.	23/ 8/1952			217.2
Seaplane	Cailloux, J. C.	France	13/10/1953			170.1
Special ...	Jancso, B.	U.S.S.R.	14/10/1951			111.801
Tailless...	Horvath, E.	Hungary	29/11/1952			162.2
Tailless Seaplane	Vassiltchenko, V.	U.S.S.R.	28/ 5/1953			102.3
Speed (Circular) Class III						
Orthodox	Sugden, R. & Brown, M.	U.S.A.	24/ 8/1952			248.8
Special ...	Vassilchenko, M.	U.S.S.R.	4/ 1/1953			138
Tailless...	Gaevsky, O.	U.S.S.R.	23/ 5/1950			163.447
Seaplane	Vassiltchenko, V.	U.S.S.R.	7/ 8/1952			93.33
Tailless Seaplane	Wilson, R.	U.S.A.	23/ 8/1952			135.8
Speed (Circular) Class IV (Jet)						
Orthodox	Husicka, Z.	Czechoslovakia	13/ 7/1952			245.052
Tailless...	Vassilchenko, M.	U.S.S.R.	9/ 1/1953			264.7
Special ...	Cheremete, V.	U.S.S.R.	11/ 3/1953			161.5

SAILPLANES

Duration				hr.	min.	sec.
Orthodox	Aidaninov, S.	U.S.S.R.	6/ 7/1950	3	18	0
Tailless...	Mouraschenko, B.	U.S.S.R.	6/ 6/1951	1	16	32
Distance						km.
Orthodox	Szomolanyi, F.	Hungary	23/ 7/1951			139.8
Tailless...	Mouraschenko, B.	U.S.S.R.	6/ 6/1951			33.36
Altitude						metres
Orthodox	Benedek, G.	Hungary	23/ 5/1948			2,364
Tailless...	Koutcer, M.	U.S.S.R.	17/ 8/1950			547

UNORTHODOX "SPECIALS" (Motorless)

Duration and Height	O'Donnell, J.	Great Britain	22/ 4/1951	4 : 20 & 1,720 m.

RADIO CONTROL

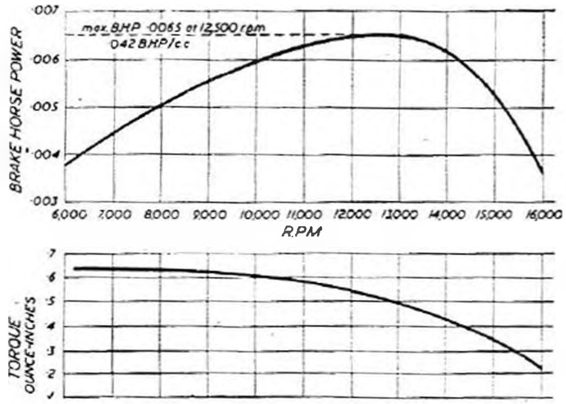
Power (*Duration, Height*)	Velitchkovsky, P.	U.S.S.R.	2-3/8/1952	1h. 31m. 14s. and 845 m.
Speed ...	Stegmaier, K. H.	Germany	21/ 3/1953	58 km./h.
Sailplane	Bethwaite, F. D.	New Zealand	16/ 5/1954	2 hr.

NATIONAL MODEL AIRCRAFT GOVERNING BODIES

In most instances the full-size national aero club is directly responsible for the conduct of model aeronautics, but in some cases, as for example the S.M.A.E., a specialist group has been delegated to handle affairs on behalf of the parent body. To avoid delays in correspondence any letters dealing with model aeronautics should always be very clearly marked as such.

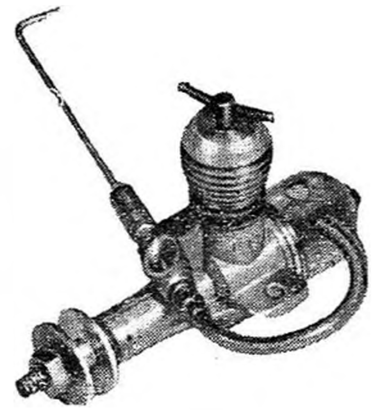
GREAT BRITAIN	The Society of Model Aeronautical Engineers, Londonderry House, Park Lane, London, W.1.
AUSTRALIA	The Model Aeronautical Association of Australia, Sec.: Robert A. Rose, 195 Elizabeth Street, Sydney, New South Wales.
AUSTRIA	Osterreichischer Aero Club, Vienna 1, Dominikanerbastei 24.
ARGENTINE	Aero Club Argentino (Seccion Aeromodelismo), Rodriguez Pena 240, Buenos Aires.
BELGIUM	Federation de la Petite Aviation Belge, 24 Av. de Haveskercke Forest-Bruxelles.
BRAZIL	Aero-Clube de Brasil, 31, Rua Alvaro Alvim, Rio de Janiero.
CANADA	Model Aeronautics Association of Canada, 1555, Church Street, Windsor, Ontario.
CHILE	Club Aero de Chile, Santa Lucia 256, Santiago.
CUBA	Club de Aviacion de Cuba, Edificio Larrea, Havana.
CZECHOSLOVAKIA	Aeroklub Republiky Ceskoslovensko, Smecky 22, Prague 11.
DENMARK	Det Kongelige Aeronautiske Selskab, Norre Farrimagsgade 3 K, Copenhagen.
EGYPT	Royal Aero-Club d'Egypte, 26 Rue Sherif Pacha, Cairo.
FINLAND	Suomen Ilmailuliitto, Mannerheimintie 16, Helsinki.
FRANCE	Federation Nationale Aeronautique (Modeles Reduits), 7, Avenue Raymond Poincare, Paris XVI. Aero-Club de France (Modeles Reduits), 6, Rue Galilee, Paris. *(Communications should always be addressed in duplicate to both these bodies as they jointly share responsibility for certain aspects of aeromodelling.)*
GERMANY	Deutscher Aeroclub, e.v. Kommissions-sekretar der MFK, (16) Frankfurt am Main, Taunusanlage 20, Germany.
HOLLAND	Koninklijke Nederlandsche Vereeniging voor Luchvaart, Anna Paulownaplein 3, The Hague.
HUNGARY	Magyar Repulo Szovetseg, V. Sztalin-ter 14, Budapest.
ICELAND	Flugmalafelag Islands, P.O. Box 234, Reykjavik.
INDIA	All India Aeromodellers Association, 8 Lee Road, Calcutta, 20.
IRELAND	Model Aeronautics Council of Ireland, 9, Lower Abbey Street, Dublin.
ISRAEL	Aero Club of Israel, 9 Montefiore Street, P.O.B. 1311, Tel Aviv.
ITALY	Federazione Aeromodellistica Nationale Italiana (F.A.N.I.), Via Cesare Beccaria 35, Rome.
JAPAN	Nippon Koku Kyokai, Kikokan (Aviation) Building 1-3 Tamura-Cho, Minato-Ku, Tokyo.
JUGOSLAVIA	Aero-Club Jugoslavije, Uzon, Mirkova IV/I, Belgrade.
LUXEMBOURG	Aero-Club du Grande-Duche de Luxembourg, 5 Avenue Monteray, Luxembourg.
MONACO	Monaco Air-Club, 8 Rue Grimaldi, Monaco.
NEW ZEALAND	New Zealand Model Aeronautical Association, c/o Mr. L. R. Mayn, 120 Campbell Road, Onehunga, Auckland.
NORWAY	Norske Aero Club, Ovre Vollgae 7, Oslo.
PERU	Aero Club del Peru, Lima.
POLAND	Aeroklub Rzeczypospolitej Polskie, Ul. Hoza 39, Warsaw.
PORTUGAL	Aero Club de Portugal, Avenida da Liberdade 226, Lisbon.
RUMANIA	Aeroclubul Republico al Romaniei, Lascar Catargi 54, Bucharest.
SOUTH AFRICA	South African Model Aeronautic Association, P.O. Box 2312, Johannesburg.
SPAIN	Real Aero-Club de Espana (Subeseccion de Aeromodismo), Carrera de Jan Jeronimo 19, Madrid.
SWEDEN	Kungl. Svenska Aeroklubben, Malmskillnadsgatan 27, Stockholm.
SWITZERLAND	Aero Club de Suisse (Modeles Reduits), Hirschengraben 22, Zurich.
SYRIA AND LEBANON	Aero Club de Syrie et du Libon, Beyrouth.
TURKEY	Turk Hava Kurumu (T.H.K.), Enstitu Caddesi, 1, Ankara.
UNITED STATES OF AMERICA	Academy of Model Aeronautics, 1025 Connecticut Avenue, Washington 6, D.C.
U.S.S.R.	Aero Club Central de l'U.S.S.R., V. P. Tchkalov, Moscou-Touchino.
URUGUAY	Aero-Club del Uruguay, Paysandu 896, Montevideo.

ENGINE ANALYSIS



ALLBON BAMBI .15 c.c.

Manufacturers. Davies Charlton Ltd., 13 Rainhall Rd., Barnoldswick, via Colne, Lancs.



Retail Price. £5/8/11.
Displacement. 0.150 c.c. (.009 cu. in.).
Power Rating. .05 B.H.P. per c.c.
Bore. 7/32 in. **Stroke.** 1/4 in.
Bore/Stroke Ratio. 7 in.
Bare Weight. 3/4 oz. (less propeller, including tank and fuel line).
Mounting. Beam (3/4 inch centres; 8 B.A.).

MATERIAL SPECIFICATION

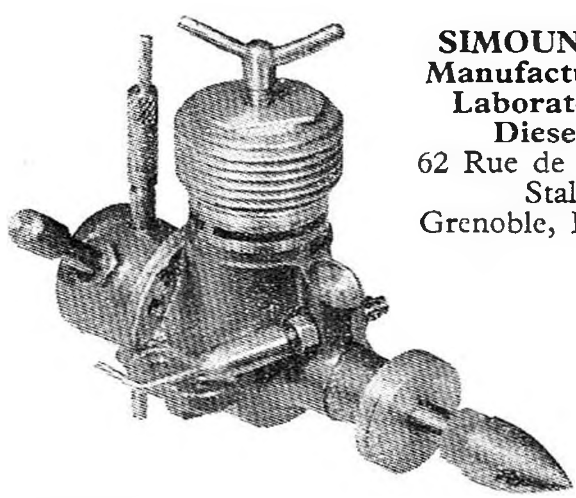
Crankcase. LAC 112A.
Crankcase Bearing. Pla n.
Cylinder. Nickel chrome steel.
Cylinder Jacket (integral head). Duralumin.
Contra-piston. Nickel chrome steel.
Connecting Rod. Nickel chrome steel.

PROPELLER TEST DATA

Propeller Pitch		Dia.	R.P.M.
4	×	1 (wood)	14,500
4		(metal)*	10,000—12,000

* Pitch of metal propeller adjusted to give maximum thrust. On the basis of flight tests a metal propeller is recommended 4 in. diameter and 3/8 inch blade width. Adjust pitch by trial and error for best model performance. This setting will be fairly critical for maximum climb. Actual performance will vary with the size and weight of the model. A wing area of 50 sq. in. is recommended with a maximum total weight (including motor) of 2 ounces. Best climb will then probably be achieved with pitch adjusted to give a motor speed of about 10,000 r.p.m.

Fuel used in all tests: Davies Charlton diesel fuel.



SIMOUN HR15

Manufacturers. Laboratoire Diesel, 62 Rue de Stalingrad, Grenoble, France.

Retail Price. 4,900 francs (£5 approx.).
Displacement. 1.5 c.c. (.09 cu. in.).
Bore. 13 mm.
Stroke. 11 mm.
Weight. 2.625 oz.
Mounting. Beam/Radial.

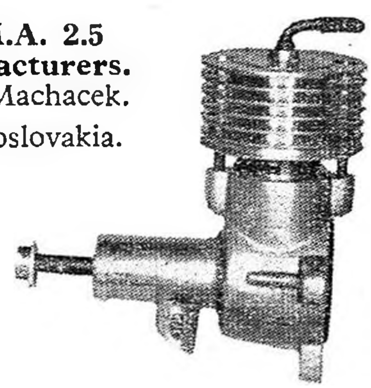
Fuel used: Mercury No. 8; and Family of constant geometric pitch wooden airscrews.

PROPELLER TEST DATA

Propeller Dia.		Pitch	R.P.M.
9	×	6	5,800
9	×	4	7,250
8	×	4	9,500
8	×	8	7,550
7	×	4	10,300
6	×	4	11,200

A.M.A. 2.5

Manufacturers. Ant. Machacek. Czechoslovakia.

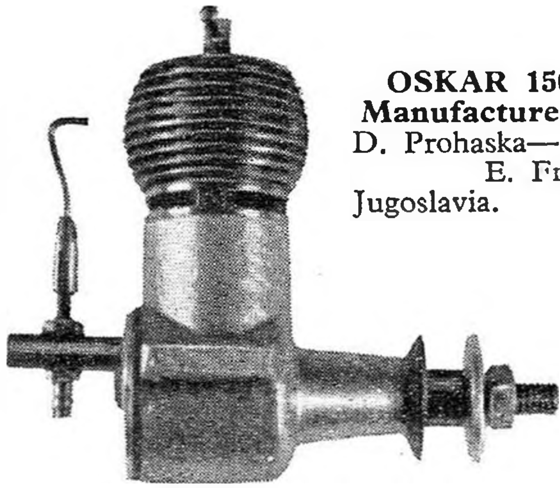


Retail Price.
Displacement. 2.47 c.c.
Bore. 14 mm. **Stroke.** 16 mm.
Bare Weight. 4 3/4 oz.
Mounting. Radial.

PROPELLER TEST DATA

Fuel used: Mercury No. 8.

Propeller Dia.		Pitch	R.P.M.
10	×	10	4,700
10	×	6	6,900
10	×	4	9,500
9	×	6	7,850
9	×	4	10,500
8	×	6	8,900



OSKAR 150

Manufacturers.
D. Prohaska—
E. Fresl.
Jugoslavia.

Retail Price.
Displacement. 1.5 c.c. (.09 cu. in.).
Bore. 0.5 in. **Stroke.** 0.46 in.
Bore/Stroke Ratio. 1 : 1.
Bare Weight. 2 7/8 oz.
Mounting. Beam.

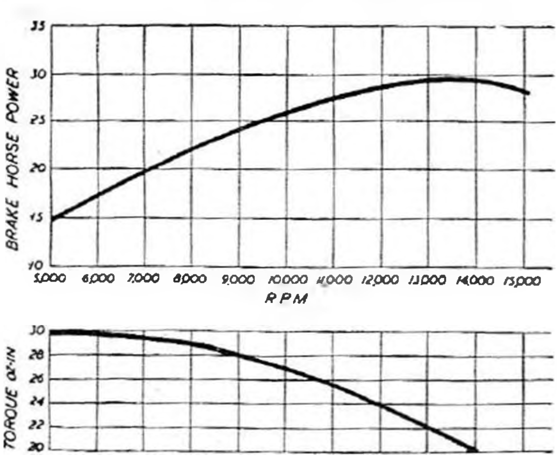
PROPELLER TEST DATA

Propeller Dia.		Pitch	R.P.M.
10	×	4	5,950
9	×	6	4,900
9	×	5	6,400
9	×	4	7,000
8	×	6	6,550
8	×	5	7,550
8	×	4	9,200
7	×	5	9,900
7	×	4	10,400
6	×	4	11,700
6	×	3	12,100

Family of constant geometric pitch wooden airscrews
Fuel used: Mercury No. 8.

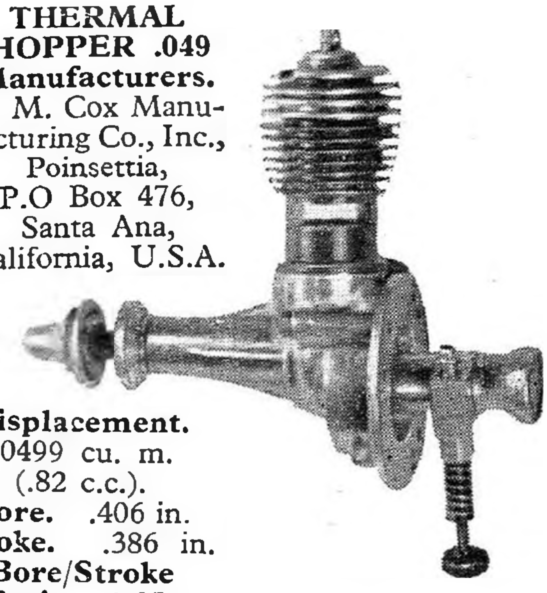
MATERIAL SPECIFICATION

Crankcase. Pressure diecast Duralumin light alloy.
Crankcase Bearings. Two ball bearings.
Cylinder. Nickel-chrome steel.
Cylinder Casing. Duralumin.
Piston. Plain.
Connecting Rod. Turned Duralumin.
Crankshaft. Nickel-chrome steel.



THERMAL HOPPER .049

Manufacturers.
L. M. Cox Manufacturing Co., Inc.,
Poinsettia,
P.O Box 476,
Santa Ana,
California, U.S.A.



Displacement.
.0499 cu. m.
(.82 c.c.).
Bore. .406 in.
Stroke. .386 in.
Bore/Stroke Ratio. 1.05.
Bare Weight.
1.35 oz.

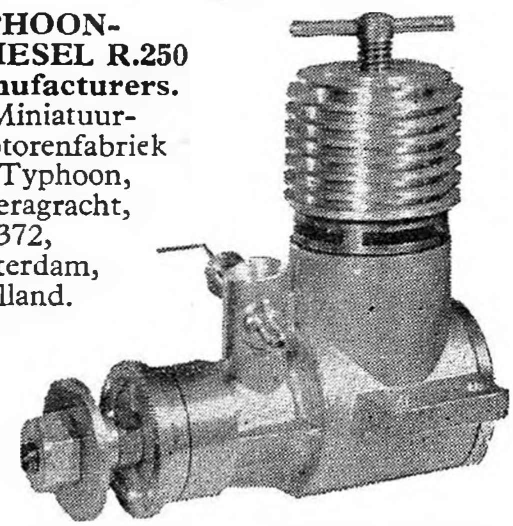
6×3 American Wood Propeller.
Fuel used:
Mercury No. 5.
R.P.M. 16,250.
Stant Wooden Propellers
Fuel used:
Mercury No. 5.

PROPELLER TEST DATA

Propeller Dia.		Pitch	R.P.M.
6	×	3	15,500
6	×	4	14,700
6	×	5	12,600
6	×	6	Inconsistent

TYPHOON-DIESEL R.250

Manufacturers.
Miniatuur-Motorenfabriek
Typhoon,
Keizeragracht,
372,
Amsterdam,
Holland.



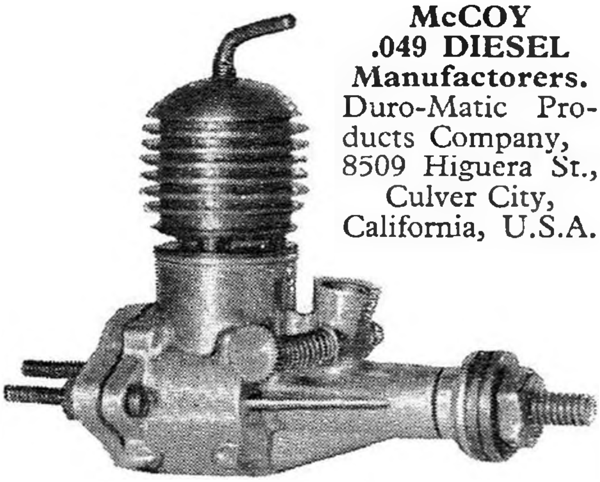
Retail Price. (Holland) 47.45 guilders (approx. £5 equiv.).
Displacement. 2.47 c.c. (.15 cu. in.).
Bore. 15 mm. (.590 in.).
Stroke. 14 mm. (.551 in.).
Bore/Stroke Ratio. 1.07.
Bare Weight. 4 3/4 oz.
Mounting. Beam.

Fuel used:
Mercury No. 8.

PROPELLER TEST DATA

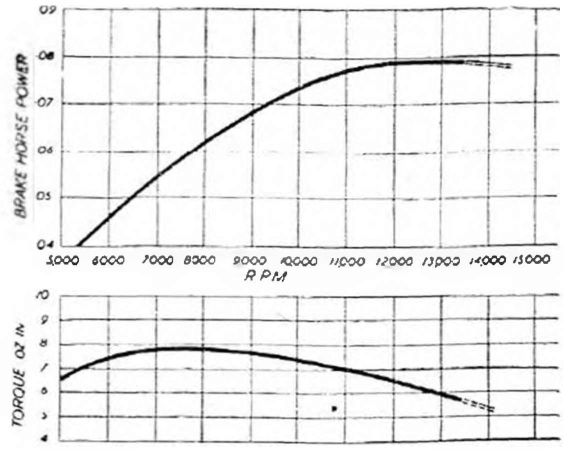
Propeller Dia.		Pitch	R.P.M.
11	×	6	6,600
10	×	6	7,400
10	×	4	8,700
9	×	6	7,900
9	×	5	8,750
9	×	9	10,900
8	×	6	9,200
8	×	5	10,750
8	×	4	11,900
8	×	3	12,750

* Constant geometric pitch wooden propellers.



McCOY .049 DIESEL

Manufactorers.
Duro-Matic Products Company,
8509 Higuera St.,
Culver City,
California, U.S.A.



Retail Price. $5.95 (approx. £2/2/0 equivalent).
Displacement. .8 c.c. (.049 cu. in.).
Bore. .405 in. **Stroke.** .386 in.
Bore/Stroke Ratio. 1.05.
Bare Weight. 1 5/8 oz.
Mounting. Radial.

MATERIAL SPECIFICATION

Crankcase. Aluminium die casting.
Crankcase Bearing. Plain.
Cylinder. Cold rolled steel.
Cylinder Casing. Aluminium.
Piston. Steel.
Contra-Piston. Steel (synthetic rubber sealing washer).
Crankshaft. Steel.

PROPELLER TEST DATA*

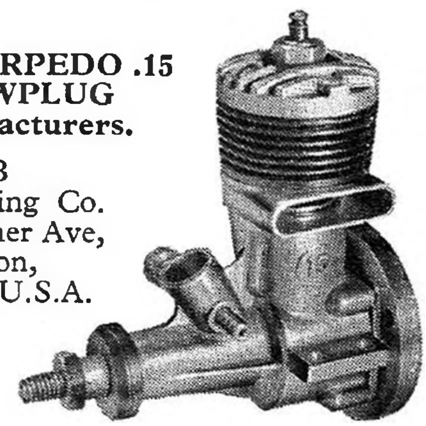
Propeller Dia.		Pitch	R.P.M.
9	×	4	5,700
8	×	6	5,450
8	×	5	6,200
8	×	4	6,700
7	×	6	5,750
7	×	5	7,500
7	×	4	8,000
6	×	5	10,000
6	×	4	11,650
6	×	3	12,250
6	×	2	13,600

* Constant geometric pitch wooden propellers.

Fuel used: Mercury No. 8.

K & B TORPEDO .15 GLOWPLUG

Manufacturers.
K & B
Manufacturing Co.
224 E. Palmer Ave,
Compton,
California, U.S.A.



Retail Price.
Displacement. 2.43 c.c.
Bore. 0.595 in. **Stroke.** 0.535 in.
Weight. 3 3/4 oz.

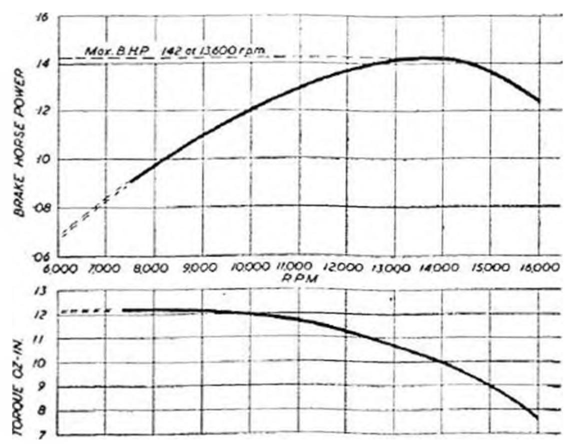
MATERIAL SPECIFICATION

Crankcase. Light alloy.
Crankcase Bearing. Plain.
Cylinder. Steel.
Cylinder Casing. Light alloy.
Piston. Hardened steel.
Crankshaft. Heat treated steel.

PROPELLER TEST DATA

Rev. Check with free flight airscrews:

ENGINE "A" (Run-in for 45 min. as per maker's advice.)	9 in. × 4 in. KK Truflo . . . 9,200 rpm. 9 in. × 3 in. Tornado Plasticote as advised in U.S.A. . . . 10,600 rpm.
ENGINE "B" (Run-in and subsequently used for several hours—the test engine.)	9 in. × 4 in. KK Truflo . . . 10,400rpm. 9 in. × 3 in. Tornado Plasticote as advised in U.S.A. . . . 12,200 rpm.



Retail Price. £6 (including tax).
Displacement. 1.47 c.c. (.08974 cu. in.).
Bore. .430 in. **Stroke.** .625 in.
Bore/Stroke Ratio. .68.
Brake Horse Power per c.c. .082.
Bare Weight. 3 3/4 oz.
Mounting. Beam 1 3/8 × 1/2 in.

MATERIAL SPECIFICATION

Crankcase. Aluminium alloy, sand cast, LAC 113B.
Crankcase Bearing. Twin ball races.
Cylinder. E.N.T. cyanide hardened; ground, lapped and honed.
Cylinder Casing (integral head). Alloy.
Piston. Brico cast iron.
Contra-piston. Brico cast iron.
Carburettor Unit. Aluminium, screw in.
Connecting Rod. R.R.56.

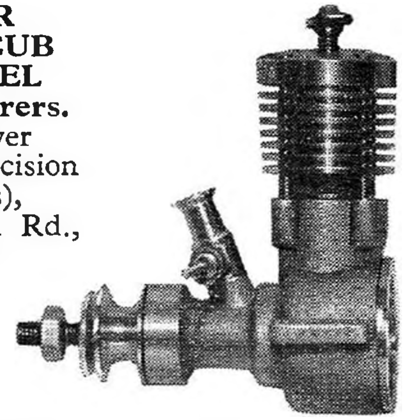
FUEL CONSUMPTION TEST
PROPELLER TEST DATA

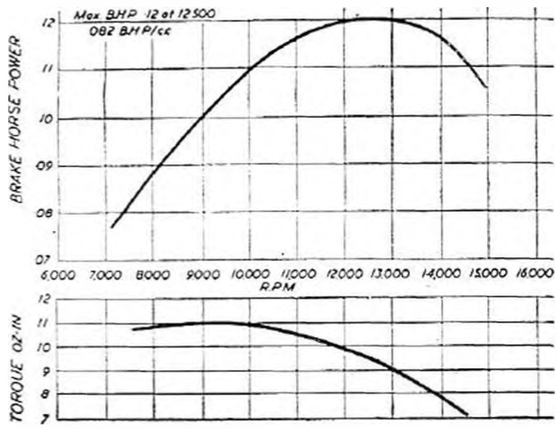
K-K9 × 4, 9,500-9,720.
Fuel used: Mercury No. 8.
K-K 9 × 4, 9,520.
Fuel used: Manufacturer's recommended.*

* First Grade Paraffin	50%
Ether	30%
Castor, Castrol R or Castrol M ...	20%
Amyl Nitrate ...	3%

OLIVER TIGER CUB 1.5 DIESEL

Manufacturers.
J. A. Oliver (JAO Precision Products), 136 Radford Rd., Nottingham.





LEO HOLIDAY, U.S.A. SPEED DATA

Engine	Prop.	U.S. Commercial Fuel	Standard Blends	Glow Plugs	Model Weight	Fuel required per flight	Size of Bladder
					ozs.	c.c.	
Thermal Hopper	4 × 6 4½ × 5	Thimble-Drome Racing	30% N.M. 20% C.O. 50% A.	Thimble-Drome Racing Plug	2—5	10—12	1½ in. L.
McCoy 19	6 × 9	Supersonic 1,000 This Is It	35% N.M. 30% C.O. 10% N.B. 25% A.	McCoy Hotpoint O & R Racing	10—15	22—25	2¼ in. L.
Torpedo 19	6 × 10	Supersonic 1,000 This Is It	50% N.M. 25% C.O. 25% A.	O & R Racing McCoy Hotpoint O.K. Long			
Fox 19	6 × 10½ 6 × ½ × 10	This Is It	50% N.M. 25-30% C.O. 20-25% A.	O & R Racing McCoy Hotpoint OK Long			
McCoy 29	7 × 10	OBR No. 4 This Is It	35% N.M. 30% C.O. 10% N.B. 25% A.	McCoy Hotpoint Champion VG-2	14—20	30	2½ in. L.
Dooling 29*	7 × 9*	This Is It*	40% N.M. 25% C.O. 35% A.	O & R Racing McCoy Hotpoint OK Long		35	
McCoy 60	9 × 12	OBR No. 4 This Is It Stardust H.	30-40% N.M. 25-30% C.O. 20-35% A. 10% N.B.	OK Long Champion VG-2	23—32	50	3 in. L.
Dooling 61	8 × 11 9 × 11	This Is It (with added Nitro)	50% N.M. 25% C.O. 10% N.B. 15% A.	O & R Racing McCoy Hotpoint		60	

Standard Blends Code:
N.M. = Nitro Methane
N.B. = Nitro Benzine
C.O. = Castor Oil
A = Alcohol

* As used by winner Bob Lutker, Texas, U.S.A., at 1954 World Speed Championships, The Hague.

JETEX UNIT DATA (AEROMODELLER TEST REPORT)

Jetex	Weight Charge ounces	Nominal or Average Thrust	H.P. Equivalent at 30 m.p.h.	H.P. Equivalent at 60 m.p.h.	Lb./H.P. at 30 m.p.h.	Lb./H.P. at 60 m.p.h.	Effective Duration (seconds)	Model Size Span (in.(	Model Size Max. Total Weight (ounces)	Dimensions Length ins.	Dimensions Diameter ins.
Atom 35 ...	3/32	3/8–1/2	.0019 .0025	.00375 –.005	6.2– 8.4	3.1– 4.2	7–8	10–12	3/4	1 5/8	9/16
50 (Standard)	7/64	1/2–5/8	.0025 –.003	.005– .00625	7.2– 9	3.6– 4.5	14–15	12–16	1 1/4	1 3/4	11/16
50 (Export) ...	7/64	1/2–5/8	.0025 –.003	.005– .00625	6.0– 7.4	3.0– 3.7	10–12	12–16	1 1/2	1 5/8	5/8
50 B	7/64	1/2–5/8	.0025 –.003	.005– .00625	6.6– 8.2	3.3– 4.1	10–12	12–16	1 1/2	1 7/8	5/8
100	1/4	1–1 1/4	.005 –.006	.01– .0125	8.8– 11.0	4.4– 5.5	14–15	16–24	3	2.5/16	1
Jetmaster	1/4	1 3/4–1 7/8	.009– .0095	.0175 –.019	6.2– 6.7	3.1– 3.35	12–15	20–30	4 1/2	3 1/2	1.1/16
350	3/8 (1) 3/4 (2) 1 1/8 (3)	3.5– 4.0	.019	.038	9	4.5	12 (1) 24 (2) 36 (3)	30– 45	12	3 3/4	1 25/64
200	5/16 (1) 5/8 (2)	2.75 3.25	.015	.030	7	3.5	12 (1) 24 (2)	24– 36	8	2 7/8	1 5/32
Scorpion	3/8	5	.025	.057	5	2.5	8–9	32–48	16	2 1/4	1 1/4

Unit	Loaded Weight (ounce)	Charge Weight (ounce)	Charge/ Loaded Weight	Maximum Thrust (ounce)	Thrust/ Weight Ratio	Thrust/ Charge Weight	Performance = T × D / Charge Weight	% Improvement with Augmenter: Thrust	% Improvement with Augmenter: Thrust/ Weight
Atom 35	1/4	3/32	.375	1/2	2.0	5.3	37.3	†	†
50 (Standard) ...	23/64	7/64	.30	5/8	1.74	5.7	68.6	†	†
50 (Export)	19/64	7/64	.37	5/8	2.1	5.7	68.6	†	†
50B	21/64	7/64	.33	5/8	1.9	5.7	68.6	—	—
50B Bellmouth only	27/64	7/64	.26	3/4	1.78	6.9	82.3	+20	—6.3
50B Short Augmenter	29/64	7/64	.24	5/8	1.38	5.7	68.6	—	—
50B Long Augmenter	31/64	7/64	.23	5/8	1.29	5.7	68.6	‡	‡
100	7/8	1/4	.29	1 1/4	1.43	5.0	60.0	†	†
Jetmaster	15/16	1/4	.27	1 7/8	2.0	7.5	90.0	—	—
Jetmaster Short Augmenter ...	1 3/16	1/4	.21	2 1/2	2.1	10.0	120.0	+33	+5
Jetmaster Long Augmenter ...	1 3/8	1/4	.18	2 1/4	1.6	9.0	108.0	+20	—20
200	1 9/16*	5/16*	.20	3	1.92	9.6	115.2	†	†
350	2 5/8*	3/8*	.14	4	1.45	10.6	128.0	†	†
Scorpion	2	3/8	.19	5	2.5	13.3	120.0	‡	‡

† Not tested with augmenter. ‡ Augmenter tests inconclusive (little definite gain in performance).
* Single charge.

Sid Allen at the Brussels International Radio Control meeting. With George Honnest-Redlich he made virtually a clean sweep of British National R.C. events using reed units and the latest products of the E.D. company by whom he is now employed. Only laurel remaining to be won appears to be that famous "Channel Crossing" !

CONTEST RESULTS

Results of S.M.A.E. Contests for balance of 1953 Season, together with principal Galas, are included in this report to complete records. Those 1954 events which have been decided before going to press are also included, and will be completed in next year's Aeromodeller Annual.

July 12th—NORTHERN HEIGHTS GALA, Langley, Bucks

THE QUEEN ELIZABETH CUP

		points
1 Barr, L.	West Middlesex	495.5
2 Mead, R.	Northern Heights	410
3 Law, R.	West Middlesex	408

THURSTON HELICOPTER TROPHY

1 Ingram, C. M.	Wilmot Mansour Club	180
2 Hodgson, A.	Andover	177
3 Smith, D.	Unattached	158

DE HAVILLAND TROPHY Open Power

1 Marsh, C.	Ilford	491
2 Cullen, B.	Sittingbourne	302
3 Cullinane, R.	Unattched	301

CORONATION CUP. Class A Team Race

1 Smith, T. South Bristol

MODEL ENGINEER CUP. Class B Team Race

1 McNess West Essex

FLIGHT TROPHY. Open Glider

		secs.
1 Brookes, A.	Grange	452.6
2 O'Donnell, J.	Whitefield	377
3 Law, R.	West Middlesex	342

FAIREY CUP. Open Rubber

1 Allaker, P.	Surbiton	520
2 Giggle, P.	Brighton	509.8
3 O'Donnell, J.	Whitefield	494

R.A.F. FLYING REVIEW CUP. Radio Control

		points
1 Sutherland, S.	West Essex	87
2 Merrick, G. W.	Worcester	85
3 Miller, S. A.	Luton	64

CONCOURS D'ELEGANCE

Power Driven Models—Hill, R.	"Cumulus"
General Flying models—Smallwood, A.	"Wakefield"
Flying Scale Models—Jackson, H. T.	"Sopwith Snipe"
Unorthodox Models—Marshall, J.	"Autogyro"

THE "AEROMODELLER" CHALLENGE CUP

O'Donnell, J. Whitefield

August 23rd—JETEX INTERNATIONAL CONTEST, Radlett, Herts.

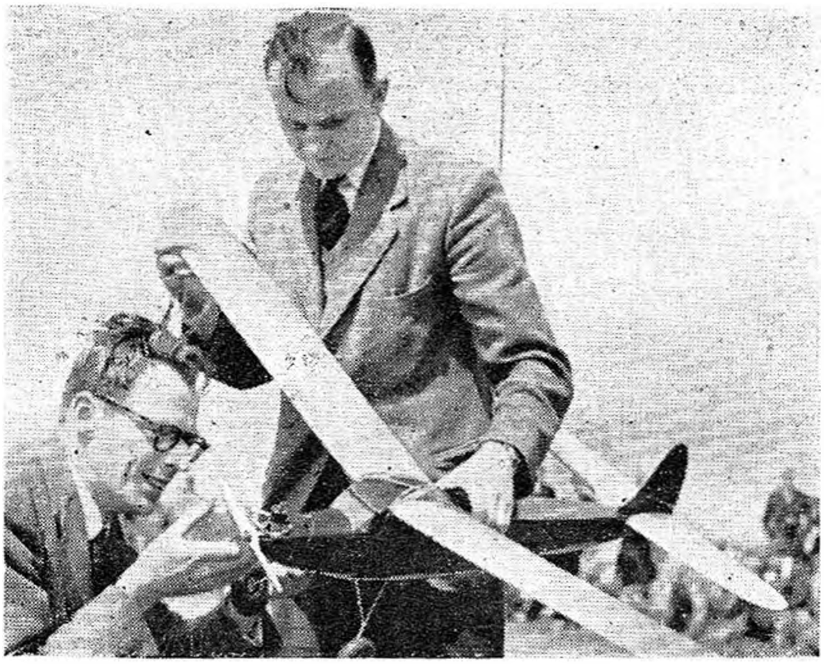
		ratio	
1 Houghton, W.	Rhyl	10.66	(Jet-master)
2 Tubbs, H.	Leeds	9.61	(100)
3 Cannell, F/O.	R.A.F.	9.10	(50)
4 Twomey, R.	Cardiff	9.07	(200)
5 Warr, N.	—	8.38	(100)
6 O'Donnell, H.	Whitefield	7.40	(350)*

* Top junior

U.K. CHAMPIONSHIPS

Rubber		
1 O'Donnell, J.	England	9 : 00
2 O'Donnell, H.	England	9 : 00
3 Gray, L.	Ireland	6 : 53
Power		
1 Upson, G.	England	7 : 34
2 Lanfranchi, S.	England	7 : 14
3 Bell, J.	Scotland	6 : 06
Glider		
1 Brooks, A.	England	7 : 30
2 Gray, L.	Ireland	6 : 49
3 Drew, G.	Ireland	6 : 12

England 15 pts., Ireland 8 pts., Scotland 7 pts. No Welsh team.



Seeking fresh fields to conquer? World renowned Wakefield specialist Bob Copland presents a Radio Controlled model for processing at this year's Nationals at Waterbeach. We are sorry to report that he did not place in the first half dozen.

August 30th—AREA CHAMPIONSHIPS, Long Marston

		Rubber Points	*Glider Points*	*Power Points*	*Total Points*
1	Midland	20	14	10	44
2	London	3	20	14	37
3	Northern	4	5	20	29
4	N. Western	14	10	3	27
5	R.A.F.	10	1	5	16
5	Southern	5	7	4	16
7	W. Scotland	2	3	7	12
8	S. Eastern	7	2	0	9
9	S. Midland	0	4	2	6
10	E. Anglian	1	0	0	1
10	Western	0	0	1	1
12	S. Wales	0	0	0	0

INDIVIDUAL CHAMPIONS

Power	Lanfranchi, S. / McMasters, J.	Joint Holders
Rubber	O'Donnell, J. / Allaker, P.	Joint Holders
Glider	Geesing, A.	

September 13th—GUTTERIDGE TROPHY

(1954 *Wakefield Eliminator*) 161 *entries*

1	Palmer, J.	Croydon	15 : 00+4 : 43
2	Albone A.	Croydon	15 : 00+2 : 58
3	Brench, F.	Hayes	15 : 00+1 : 58
4	Haisman, B.	Whitefield	15 : 50
5	Monks, R.	Birmingham	14 : 34
6	Warring, R.	Zombies	14 : 30

September 13th—MODEL ENGINEER CUP

(55 *entries*)

1	Croydon	32 : 38
2	Birmingham	31 : 31
3	St. Albans	30 : 36
4	Northwick Park	30 : 28
5	Surbiton	29 : 05
6	Grange	25 : 39

September 27th—K. & M.A.A. CUP

(1954 *A2 Eliminator—342 entries*)

1	Martin, P.	Birmingham	15 : 00+2 : 05
2	Sprason, E.	Birmingham	15 : 00+1 : 02
3	Yeabsley, R.	Croydon	14 : 21
4	Hanson, M.	Birmingham	13 : 55
5	Smith, B.	Boston	13 : 53
6	Young, F.	Sutton Coldfield	13 : 30
6	Lamble, J	West Herts	13 : 30

September 27th—HALFAX TROPHY

(1954 *Power Eliminator*—190 *entries*)

1	Perkins, G.	Croydon	15 : 00+5 : 53
2	Buskell, P.	Surbiton	15 : 00+5 : 44
3	Upson, G.	Northwick Park	15 : 00+4 : 53
3	Jays, V.	C.M.	15 : 00+4 : 53
5	Hancock, J.	Surbiton	15 : 00+3 : 35
6	Blunt, J.	Croydon	15 : 00

October 18th—RIPMAX TROPHY

			points
1	Allen, S.	West Essex	405
2	Rhodes, M.	Harrow	397
3	Merrick, W.	Malvern	339
4	Sills, E. C.	Bedford	326

1954 Contest Results

March 14th—GAMAGE CUP

Unrestricted Rubber — *Decentralised*

(40 *entries*)

1	O'Donnell, J.	Whitefield	10 : 44
2	Palmer, J.	Croydon	9 : 53
3	Gorham, J.	Ipswich	9 : 32
4	Christie, C.	Bucksburn	9 : 24
5	Bennett, E.	Croydon	8 : 17
6	Thomas, V.	Northwick Park	8 : 03

March 14th—PILCHER CUP

Unrestricted Glider — *Decentralised*

(61 *entries*)

1	Henderson, J. D.	Sunderland	9 : 19
2	Laxton, D. A.	Oundle	9 : 04
3	Wisher, A.	Brixton	8 : 51
4	Waldron, J.	Henley	8 : 37
5	Kay, J.	Loughborough	7 : 25
6	Gooding, G.	Hull Pegasus	7 : 19

March 28th—S.M.A.E. CUP

(*2nd 1954 A/2 Eliminator*)

A/2 Sailplane — *Area*

(160 *entries* 117 *disqualified*) †

1	King, M. A.	Belfairs	12 : 00+1 : 41
2	Yeabsley, R.	Croydon	11 : 00
3	Larcey, P.	Henley	10 : 47
4	Cooke, A.	Henley	10 : 15
5	Hutton, B.	Northwick Park	10 : 09
6	Upson, G.	Northwick Park	10 : 00

March 28th—WOMEN'S CHALLENGE CUP

Unrestricted — *Area*

(8 *entries*, 4 *disqualified*) †

1	Healey, Miss P. R	Belfairs	8 : 28

2	Moulton, Mrs. B.	West Herts	6 : 29
3	Parkinson, —.	Leeds	5 : 32
4	Sayer, J.	Chelmsford	2 : 50

March 28th—FARROW SHIELD

Team Rubber — *Area*

(16 *clubs*, 14 *disqualified*) †

1	Croydon D.M.A.C.	40 : 39
2	Leeds M.F.C.	38 : 49
3	West Middlesex M.A.C.	32 : 48
4	Northern Heights M.F.C.	30 : 21
5	Cowley M.A.C.	27 : 40
6	Sheffield S.M.	24 : 10

March 28th—JETEX CHALLENGE CUP

Jetex — *Area*

(18 *entries*, 13 *disqualified*) †

1	Dowsett, I.	West Middx.	25.43	ratio
2	Snewin, J.	Blackheath	22.33	"
3	Roberts, G. L. Z.	Lincoln	17 : 80	
4	Monument, R.	Lincoln	17 : 02	
5	Hancock, J.	Cowley	16 : 80	
6	Allaker, P.	Surbiton	16 : 45	

(† *Disqualification in consequence of submission of results by secretaries too late*).

April 25th—WESTON CUP

(*2nd* 1954 *Wakefield Eliminator*) — *Area*

(113 *entries*)

1	Green, M.	Men of Kent	12 : 00
2	O'Donnell, J.	Whitefield	11 : 14
3	Monks, R.	Birmingham	10 : 18
4	Thomas, G.	Slough	10 : 09
5	Copland, R.	Northern Heights	10 : 03
6	North, J.	Croydon	9 : 40

April 25th—ASTRAL TROPHY

(*2nd* 1954 *Power Eliminator*) — *Area*

(136 *entries*)

1	Petty, C.	Flying Saddlers	11 : 42
2	Bedale, R.	Flying Saddlers	11 : 42
3	Monks, R.	Birmingham	10 : 22
4	Day, B.	Flying Saddlers	10 : 05
5	Lanfranchi, S.	Bradford	9 : 56
6	Marcus, N. G.	Croydon	9 : 27

June 5th, 6th, 7th—BRITISH NATIONALS

Held at R.A.F. Waterbeach, Nr. Cambridge

LADY SHELLEY CUP—Tailless

1	Smith, F.	Southern Cross	6.33
2	Bennett, H. R.	Regents Park	5.48
3	Thomas, M.	Blackpool	5.12
4	Crawshaw, I.	St. Albans	4.00
5	Gates, M. M.	Country Member	3.50
6	Hume, J.	Belfairs	3.42

BOWDEN TROPHY—Precision Power

1	Rushbrooke, C. S.	Fellow	990
2	Ellis, L.	R.A.F. Debden	932
3	Cripps, G.	Abingdon	866
4	Monument, R. C.	Lincoln	844
5	Binney, Col.	Eastbourne	826
6	Tinker, W.	Epsom	800

THURSTON CUP—Glider

1	Byrd, G. C. M.	Loughborough Coll.	11.31
2	Painter, D.	Henley	10.06
3	Clements, R.	Luton	9.45
4	Gelray, A.	Croydon	9.44
5	Welbourne, E.	Hayes	9.38
6	Tipper, D.	St. Albans	9.31

SHORT CUP—PAA-Load

1	Marsh, C.	St. Albans	8.55
2	Bickerstaffe, J.	Birmingham	7.37
3	Moulton, R.	West Herts	7.00
4	Fuller, G.	St. Albans	6.52
5	John, E.	Grange	6.30
6	Monks, R.	Birmingham	6.20

MODEL AIRCRAFT TROPHY—Rubber

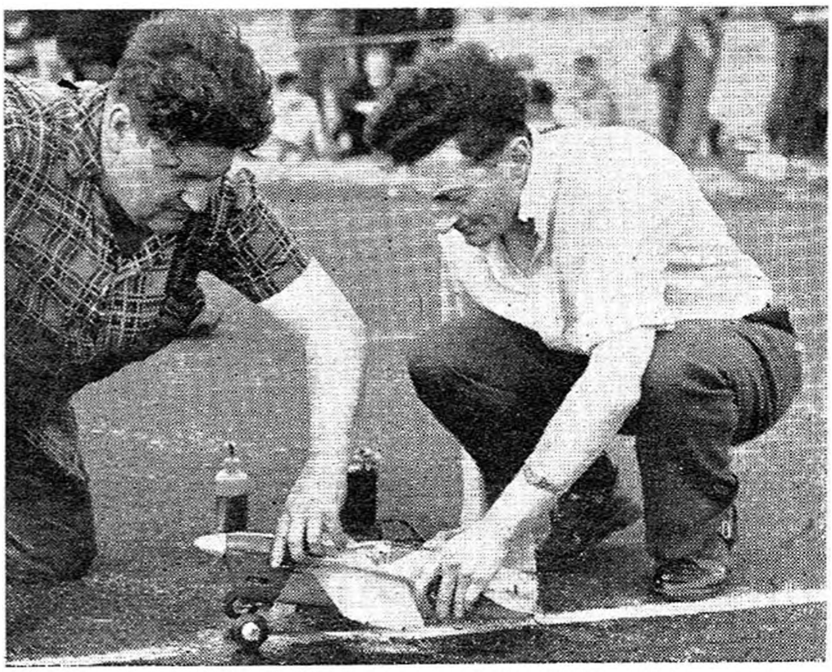
1	North, R.	Croydon	11.51
2	Blount, J.	Croydon	11.43
3	Snewin, J.	Blackheath	11.34
4	Chesterton, R.	Northern Heights	10.45
5	Yates, D.	Wigan	10.43
6	Copland, R.	Northern Heights	10.32

TAPLIN TROPHY—Radio Control

1	Allen, S.	Bushy Park	402
2	Honnest-Redlich, G.	Bushy Park	313
3	Panteny, R.	Eastbourne	218
4	Hemsley, E.	Hatfield	201
5	Lewis, R.	Eastbourne	190
6	Miller, S.	Luton	154

SIR JOHN SHELLEY CUP—Power

1	Smith, J.	English Electric	11.34
2	Glynn, K.	Brixton	11.28
3	Marcus, N.	Croydon	11.18
4	Bickerstaffe, J.	Rugby	10.50
5	Nixon, E.	Hinckley	10.18
6	Wheeler, B.	Birmingham	9.45



"Stoo" Steward and Denny Allen of West Essex with their Jack of Diamonds, 1954 B Class T/R Champion. "Stoo" is now a pushful "combat" expert, while Denny has realised his ambition by producing the Allen-Mercury engine, a promising new 2.5 c.c. commercial job.

SUPER SCALE TROPHY—Power Scale

1	Datkiewicz, Z. A.	Polish, A.F.A.	75
2	Bridgewood, I.	Doncaster	73
3	Garwood, M.	Epsom	65
4	Deefee, D.	Epsom	50

S.M.A.E. TROPHY—Radio Control

1	Honnest-Redlich, G.	Bushy Park	330
2	Allen, S.	Bushy Park	197
3	Higham, R. S.	Country Member	146
4	Fox, J.	Hatfield	100
5	Botting, A.	Leicester	69
6	Sutherland, S.	West Essex	50

GOLD TROPHY—C/L Stunt

1	Smith, P.	Chingford	353
2	Miske, J.	U.S. Army	308
3	Lloyd, E.	R.A.F.	303
4	Russell, P.	Country Member	297
5	Muscutt, K.	West Essex	292
6	Buck, R.	Five Towns	282

EASTBOURNE TROPHY—Team Race A

1	Edmonds, R.	High Wycombe	10.04
2	Lee, R.	High Wycombe	10.05
3	Sharpe, P. G.	Chingford	10.38

GODALMING TROPHY—Team Race B

1	Cameron, P.	Croydon	8.29
2	Steward, L.	West Essex	
3	King, W.	Northern Heights	

SPEED CLASS 1—2.5 c.c.

Wright, P. St. Albans *111 m.p.h.

SPEED CLASS—2—5 c.c.

Powell, D. East London *133 m.p.h.

SPEED CLASS 3—10 c.c.

Gibbs, R. East London *144 m.p.h.

SPEED CLASS 4—Jet

Claydon, J. East London 128 m.p.h.

* *New British Records (subject to Ratification)*

June 13th—"DAILY DESPATCH" RALLY, Woodford

JETEX

1	Thomas, M.	Blackpool	26.4 ratio
2	O'Donnell, J.	Whitefield	19.35
3	Davey, C. J.	Blackpool	14.43

P.A.A. LOAD

1	Horwich, E.	Whitefield	3.54

COMBAT STUNT

1	Arden, J. D.	Ashton
2	Howarth, —.	

RIDING MEMORIAL TROPHY
(F/F Flying Scale)

1	Bridgewood, J.	Doncaster
2	Coates, E. A.	Goole

CLASS A TEAM RACING

1	Bolton, D.	Foresters
2	Howard, J.	,,
3	Russell, P.	Worksop

POWER

1	Mordin, E. (J)	Whitefield	13.25
2	Barrett, J.	Wolves	8.24
3	Smith, T. W.	English Elect.	7.34

RUBBER

1	O'Donnell, H. (J)	Whitefield	9.24
2	Rhead, T.	Wigan	8.59
3 {	Marsden, F.	Blackpool	7.36
	Miller, C. R.	Bradford	7.36

GLIDER

1	O'Donnell, H. (J)	Whitefield	6.00
2	Lenssen, S.	Tame	5.20
3	Girling, C.	Ashton	5.18

Senior Champion	Eckersley, G.	Burnley
Junior Champion	O'Donnell, H.	Whitefield
Women's Cup	Miss W. Bennett	Whitefield

July 11th—I.R.C.M.S. MEETING

(Radio Control) (15 *entries:* 8 *completed flights*)

1	Honnest-Redlich, G.	376 pts
2	Allen, S.	266 ,,
3	Nachtman, T. S.	196 ,,
4	Hemsley, O. E.	158 ,,

July 11th—CLWYD SLOPE SOARING MEETING

GOSLING TROPHY

1	Hutton, G. M.	Wallasey	14.39

OPEN EVENT

1	Brooke, N. P.	Crosby	14.15
2	Redfern, S.	Chester	11.15

NORDIC EVENT

1	Hutton, G. M.	Wallasey	14.39
2	Chadwick, J.	Ashton-under-Lyme	11.17

RADIO CONTROL EVENT

1	Fittness, C. R.	Chester

JUNIOR

1	Simmons, K.	New Brighton	6.36
2	Brown, M.	,,	4.47

June 20th—NORTHERN HEIGHTS M.F.C. GALA, Langley Aerodrome

FLIGHT CUP (Gliders)

1	Waldron, J.	Henley	600 (F/O)
2	Dowsett, I.	West Middx.	600

FAIREY CUP (Rubber)

1	Gorham, J.	Ipswich	600 (F/O)
2	Giggle, P.	Brighton	600

QUEEN ELIZABETH CUP (Power)

1	Marsh, C.	St. Albans	687 points
2	Jayes, V.	C.M.	682 ,,
3	Buskell, P.	Surbiton	666 ,,

THURSTON HELICOPTER TROPHY

1	Ingram, I.	Southampton
2	Boreham, R.	,,

DE HAVILLAND TROPHY (Power)

[1	French, G.	—	600
[2	Postner, C.	N.W. Middx.	462

CORONATION CUP (Team Racing A)

1	Welham, P.	Belfairs
2	Hayward, L.	Chingford

M.E. CUP (Team Racing B)

1	Martin, R.	Chingford
2	Muscutt, K.	West Essex

CONCOURS D'ELEGANCE

Rising, F. Leicester

RADIO CONTROL SPOT LANDING R.A.F. REVIEW CUP

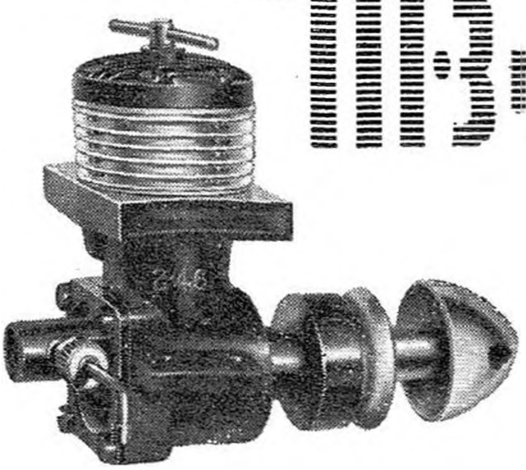
1	Robertson, I.	W. Herts	25½ ft.
2	Chapman, L.	Luton	30

AEROMODELLER CUP: Championship

Postner, C. N.W. Middx.

E.D *The finest Diesels for all models*

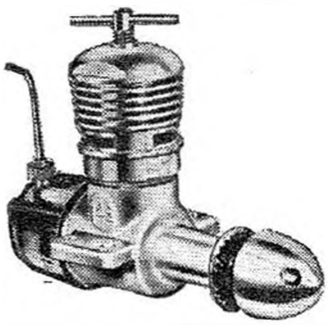
111·3 m.p.h.! A NEW BRITISH RECORD



This amazing performance in the BRITISH NATIONALS was accomplished by Pete Wright, using the wonderful E.D. 2.46 c.c. RACER. One of seven famous E.D. Diesels, every one of which has an International reputation for Power, Speed and Performance.

E.D. 2.46 c.c. RACER **£3 18s. 5d.** Water cooled **£5 4s. 6d.**

All prices include Purchase Tax



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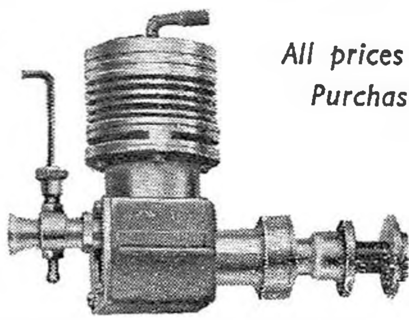
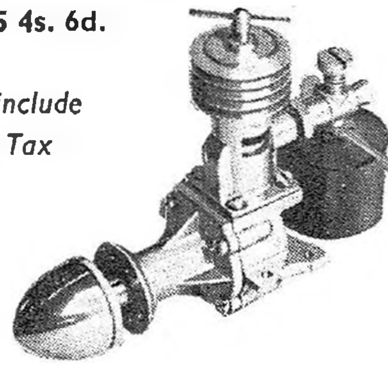
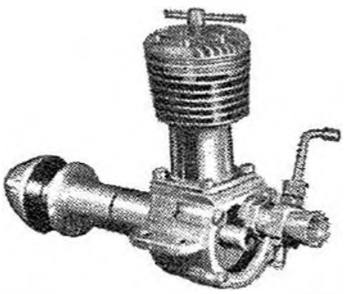


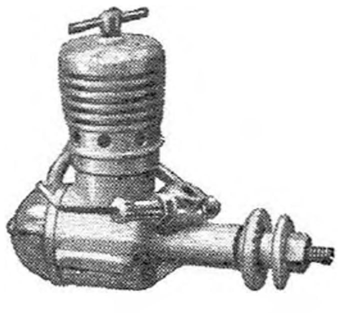
E.D. 5 c.c. MILES SPECIAL **£8.6.3** Water cooled **£9.19.6**



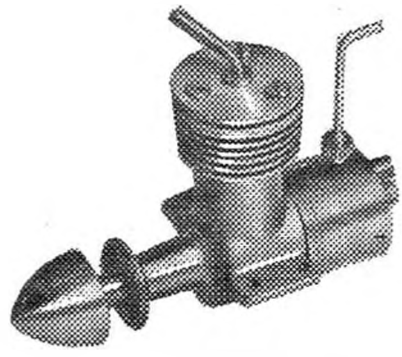
E.D. 2 c.c. COMPETITION SPECIAL **£3.1.9** Water cooled **£4.5.6**



E.D. 3.46 c.c. HUNTER **£3.18.5** Water cooled **£5.4.6.**



E.D. .46 c.c. BABY **£2.13.5**



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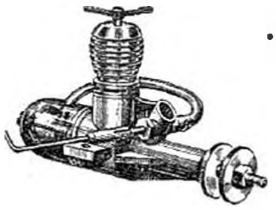
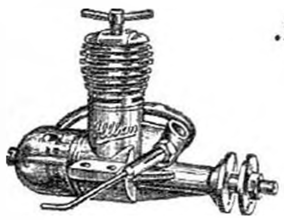


.15 c.c. **108/11**

Built like a watch, this triumph of production engineering will delight the true enthusiast.

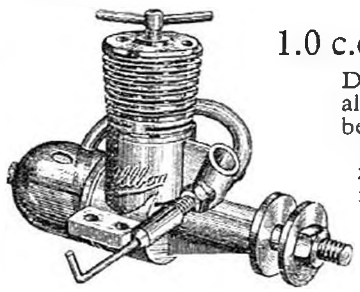
DART



.5 c.c. **64/2**

The most powerful "point five" in the world, and ideal for small free flight and scale models.

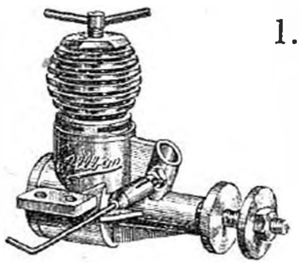
SPITFIRE



1.0 c.c. **64/2**

Designed especially for the beginner, this is the easiest starting engine on the market.

JAVELIN

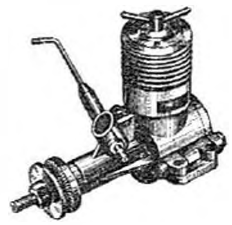


1.49 c.c. **65/4**

Top line performance makes this the ideal motor for contest work. Also suitable for radio control models.

All in Stock at Your Local Dealers

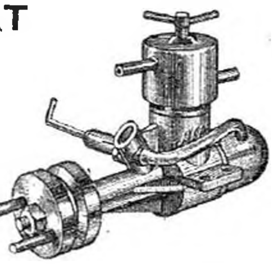
The New MERLIN



.76 c.c. **47/6**

The perfect all-rounder. Terrific performance at low cost made possible by quantity production. Beam or Radial mounting.

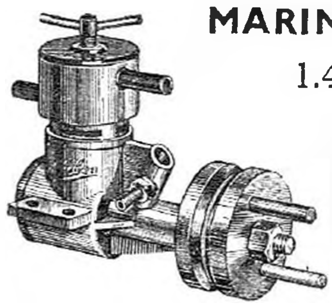
MARINE DART



.5 c.c. **83/10**

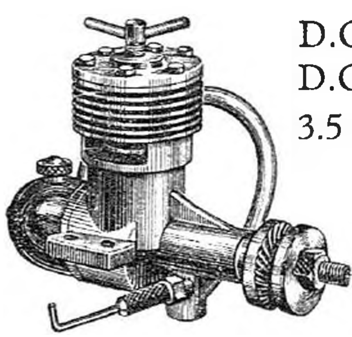
Ideal for small boats. Complete with special water cooled jacket and flywheel.

MARINE JAVELIN



1.49 c.c. **85/2**

For the radio control boat enthusiast this is the perfect engine. Includes water jacket and flywheel.



D.C. 350 &
D.C. 350 (G)

3.5 c.c. **78/5**

Diesel motor is illustrated, with alternative glo-plug version available.

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